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ASTOR, LENOX AND
TILDEN FOUNDATIONS

THE GLASGOW

MECHANICS' MAGAZINE;

AND

ANNALS OF PHILOSOPHY.

VOL. III.

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TO

HENRY BROUGHAM, ESQ.

OF BROUGHAM HALL, M. P., F. R. S.

THE UNWEARIED ADVOCATE OF POPULAR EDUCATION,

WITH PERMISSION

THE CONDUCTORS RESPECTFULLY DEDICATE

THIS VOLUME.

MEMOIR

OF

PROFESSOR ANDERSON.

THERE is a natural desire in man to know all which can be known of those who have proved benefactors of the human race; to obtain, as it were, personal intercourse with them; and, as spectators, to view their private life. Yet of one who has devoted himself to the advancement of Science or the Arts, there is often but little known, and though all were known, little to relate which can afford general interest, except the benefits his labours have conferred on man, or the studies in which the brief period of his existence was spent. When we have told the one or two great acts which it was the business of his life to accomplish: when we have said of Watt, that he was the improver of the steam engine—rendering that which had hitherto been comparatively powerless and of little value, an engine of inexhaustible power and incalculable value: that Arkwright invented a machine, by which one man is enabled to do the work which formerly required hundreds to perform: that Professor Anderson, perceiving, in the imperishable mind of man, a moral engine of hitherto untried, but almost infinite power, opened the way to its improvement, thus giving that impulse to the present age which it has received, and which nothing can ever retard or destroy: when we have said these things, we have indeed said nearly all that is important—and we have said sufficient to make their fame boundless as the earth, imperishable as time. Still, however, it is advantageous to relate their private life; to give the world the lesson of their moral worth—their many virtues. The biography of kings and conquerors, or those who have led more active lives, may excite greater curiosity, and involve a more intense interest; but never can be so truly, so extensively useful. Like the flower, which not only gives out its fragrance whilst it spreads its beauty to the sun, but even after it is withered and that beauty gone, the philosopher benefits the world by his discoveries during his life, and by the influence of his example after his death.

But besides this general reason, there is yet another for writing the life of Professor Anderson—the extension, if not the preservation of his fame. Mankind does not always reward great actions with the fame which they deserve; and the names of the greatest benefactors of the human race, are sometimes allowed to perish in the tide of time, or to be remembered only in the traditions of those grateful hearts, who have been immediately benefitted by their goodness. Fame is indeed much oftener the effect of adventitious circumstances, than of real merit; and thus, whilst one name is lauded above measure, and held up for public admiration, another, probably that of one far more deserving, is either quite unheeded, or but partially known.

We cannot help thinking this has been the case, in a very great degree, with Professor Anderson. Without wishing to detract, in the smallest degree, from the merits of Dr. Birkbeck, for whom we have every feeling of respect and esteem his exertions in the cause of popular education are calculated to excite, it is impossible we think to dispute, that Professor

Anderson, at a time when education, all but the mere elements of reading and writing, was confined to those who had the means of going through the regular course of a College education, broke through existing prejudices, and opened the Temple of Science to the hard labouring mechanic, and the hitherto despised artificer—that he is entitled to the appellation of the father of Mechanics' Institutions. Yet of this valuable man, how little is known to the world! how very little is known to the inhabitants even of the City in which he spent his life—where he made all his exertions in behalf of science—and for the benefit of the inhabitants of which, he left the bulk of his ample fortune, that, even after his death, her citizens, particularly her mechanics and her artizans, might have the means of scientific education, without being subject to the monastic trammels in which our Colleges are still invested! It will hardly be believed, we suspect, but it is a fact, that, notwithstanding nearly thirty years have elapsed since the period of his death, no biography of him has ever been published; and that in the most popular and extensive Biographical Dictionaries, there is not even mention of his name. In stating this, it is impossible not to recollect, that when Professor Anderson founded his University, he appointed eighty-one Trustees from the different professions and public bodies of the City; that from these Trustees are selected twelve Directors to manage the affairs of the Institution; and that these Directors, besides their other duties, were evidently, in an especial manner, entrusted with the preservation of his fame: and yet, we would ask these gentlemen, what they have ever done to insure either its preservation or its extension? To supply their culpable neglect, and to do tardy justice to the dead, we have felt ourselves called upon to draw up this short biography of his life; and we have peculiar pleasure in being able, (notwithstanding the opposition and difficulties thrown in our way by those who would have acted very differently, had they been as anxious for the honour of Professor Anderson as they were to oppose us,) through the kindness and liberality of a gentleman, to whom we return our sincere thanks, to present our readers with a beautiful engraving of the Professor, from the hands of Mr. Swan.

John Anderson, M. A., F. R. S. Lond. & Edin., F. A. S. Scot., M. N. His. S. Lond., M. Soc. Agr., and Econ. Emp. of Russia, Professor of Natural Philosophy in the University of Glasgow, was born in the Parish of Roseneath in Dumbartonshire, in the year 1726. His father, the Rev. James Anderson, who was Minister of that Parish, died whilst the subject of this Memoir, his eldest son, was yet young. He was, however, carefully brought up by, and received a very liberal education from, his aunt, Mrs. Turner, the widow of one of the Ministers of the High Church of Stirling. The early part of his education he received at Stirling, the more advanced part of it in the University of Glasgow, of which he was destined to prove so distinguished an ornament. In the year 1745, when Stirling was besieged by the Pretender, those of the inhabitants who were friends to the existing Government, formed themselves into a Regiment for the defence of the city, and Mr. Anderson, with all the ardour and enthusiasm of youth, joined this body, and, as one of its officers, assisted in the defence. The carabine which he then carried, is still among the property bequeathed to the Institution which he afterwards founded. In 1756, he was appointed Professor of Oriental Languages in the College of Glasgow; and in 1760, he was transferred to the Chair of Natural Philosophy at the time he was residing at Toulouse in France.

Professor Anderson, who clearly saw the intimate connection between Science and the Arts, and the great benefits which they mutually confer on each other, delighted in visiting the workshops of the artizans and mechanics, and giving them such information as was likely to benefit them in their respective arts, receiving in return a knowledge of these which he could not otherwise have obtained. The want of an experimental course of Natural Philosophy, to which the working classes, and indeed all those whose pursuits did not enable them to conform to the prescribed routine of academical study, was early perceived by him; and he accordingly added, to his customary course of lectures in Physics, which was strictly mathematical, one of a more popular nature, illustrated by experiments, according to the plan afterwards developed in his Institutes of Physics. This class continued to meet every session, upon the Tuesdays and Thursdays, during the rest of the Professor's life. Numbers availed themselves of the opportunity thus afforded them, for the first time, of obtaining a knowledge of science; and thus, within the walls of the College of Glasgow, there was a large class of operative mechanics and artizans, receiving instructions in science, which hitherto had been to them quite inaccessible as the pages of a sealed book. This class, which he called his Antitoga Class, received every encouragement from the Professor which it was in his power to afford. He began to collect for its use, an apparatus of his own, and specimens of Natural History, of which he afterwards formed a large collection. As an instance of his good sense, and his anxiety for the prosperity of this class, it may be stated, that a mechanic having complained to his assistant, that he had little time, after leaving his work, to change his dress before coming to the class, and having suggested the propriety of their being allowed to attend without such change, upon its being made known to him, it was at once acceded to.

It was to be expected, that a man, endowed with such liberal and enlightened views, would, in all questions which might arise, take the popular side, and would not remain on the best of terms with his Brother Professors. For a time, all went well; and he was allowed to take the management of almost every thing connected with the Faculty of the College: but at length a dispute arose between the Professors and the Students about the election of their Rector, when, as was to be anticipated, Professor Anderson entered into the views of the Students. Soon after this, another dispute arose about the method of keeping the College accounts. He raised an action against his Brethren, which however he lost; but he had the satisfaction, before he died, of seeing the same Professors bring an action against the son and heir of their late Factor, for his mal-administration, and for the recovery of £10,000 which had been lost to the funds of the College. Morthland, the Factor's son, produced, in the law-suit, a superb silver bowl given to his father by the Professors, with an inscription in testimony of his faithful services as their Factor. This had been done at the time their minds were elated with the victory, as they then thought, they had obtained over the Professor; but a more circumspect scrutiny showed them, that they had been wrong, and he right. The Professors, however, were as unfortunate in this action as Professor Anderson was in his; and, notwithstanding the equity of their case, they did not succeed in obtaining restitution of the £10,000.

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JOHN ANDERSON. A.M.F.R.S.E & L.

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Glasgow Published by W.R. M^{c} Phun Trongate. 1825.

THE GLASGOW

MECHANICS' MAGAZINE;

ANNALS OF PHILOSOPHY.

[illegible]

[illegible]

DESCRIPTION OF THE IMPROVED AXLES AND WHEELS.

Invented by James Aird and James Dunlop, Ayr Colliery; and for which a Premium of Seven Guineas was voted at last Meeting of the Highland Society.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—We beg to send you a description of the axle and wheels which we invented for the use of the coal waggons plying upon the rail-way belonging to Messrs. Taylors, of this Colliery, and given in by us to the Highland Society of Scotland, by whom we have been awarded a premium for our invention. We likewise enclose you a drawing of the axles and wheels, with a description of the same.

Fig. 1, represents the axles and wheels, when full mounted, ready for attaching to the waggon. A, the iron axle; B, the wooden bed of the axle; C, the ruff in the wheel; D, the collar which goes into the ruff on the wheel; E, the catch, or sneck, which prevents the collar from flying out of the ruff on the wheel.

Fig. 2, represents the axle.

Figs. 3 and 4, represents the wheels.

Figs. 5 and 6, represents the collar for securing the wheels to the axle.

If you deem the enclosed drawing and description worthy of a place in your Magazine, it may perhaps be the means of suggesting ideas of more improvement upon this subject, and your insertion of the drawing and description will very much oblige,

Gentlemen, yours, &c.
James Aird.
James Dunlop.

Ayr Colliery, 7th Feb. 1825.

Gentlemen,—The axles and wheels, as per the enclosed drawing and description, have been in use upon our rail-ways here for about nine months; and we have found, in using them, a great saving in grease, and the friction much lessened from the sand and dust not getting into the axle. The waggons are, therefore, much easier drawn; so much so that we are now engaged in fitting up our small under-ground waggons upon the improved plan; and, as the waggons now in use upon the old plan wear out, we re-fit them upon the improved plan, and have now at work forty waggons upon the improved construction.

I am, Gentlemen, yours, &c.
Archd. Kerr,
Manager of the Works.

Ayr Colliery, 7th Feb. 1825.

NEW PORTABLE PRINTING PRESS.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—I was much pleased with the simplicity and ingenuity of Mr. North's copying press, lately described in your Magazine. It occurred to me that that invention might be easily applied to the construction of presses for letter-press and lithographic, and other kinds of printing. If the following plan of applying it to these arts, meets your approbation, you can give it a place in your Magazine.

Fig. 7, represents a stout table, the top of which is made of boards $1\frac{1}{2}$ or 2 inches thick, and which is equal in breadth and length, and double in both to the breadth of the press. The upper board of the press, upon which the fulcrums of the levers are fixed, is supported $1\frac{1}{4}$ inch from the top of the table by two thin pieces of wood, *a*, *c*, placed on edge, and is surrounded on the sides E D, D F, and F G, by a stout border, the height of which coincides with the top of the board when it rests on the pieces of wood *a*, *c*. The border is also continued along the sides E B, and G H, but these rise only one inch above the top of the table. The fulcrums differ from Mr. North's only in having a hole through the top for the levers to pass through, instead of lying upon them, in order that when the longer arms of the levers are pushed up they may carry up and suspend the board by the fulcrums. From the ends of the levers *b*, *b*, are suspended iron rods, *f*, *f*, which are connected together by the bar *i*, and are bent to remove the bar *i* farther from *k*, where the lever *k*, *m*, is fixed to the bar of the table.

Fig. 8, is a board half an inch thick, nearly the same size with A, having a bracket, three-fourths of an inch thick, firmly fixed along its sides B A, and D C, with a handle at *h*. This board is designed to carry the types, stone, &c. which must be placed between the brackets, and wedged between them. It must have also attached to it an iron frame, D, F, G, C, covered with leather, to fold down upon the types after the paper has been placed upon them, to prevent the paper being deranged when the board is pushed under the press.

To use this machine, the board with the types, &c. is placed on the half of the table E, H, and the ink applied to the types. The foot of the operator is then to be placed at *o*, on the lever *n*, *o*, and *o* pressed down till the other end of the lever has, by lifting up the bar *i*, raised the levers *b*, *b*, till A is suspended so high that the board with types, &c. can slide easily below it. The foot is then to be removed, and applied to press down *m*, which will produce a strong pressure upon the types. If we suppose the long arms of the levers, *b*, *b*, to be to the short as five to one, that *i* is fixed in the middle of *k*, *m*, and that a weight of 100 lbs. is applied at *m*, A will be pressed upon the types with a force equal to 1000 lbs. independent of the weight of the board, levers, bar, &c. Presses of this kind might be made larger than Mr. North's for I think about three times his estimate, and I at present know no reason why they should not answer the purposes I propose them for well, though I must own myself unacquainted with the practice of these arts.

I am, GENTLEMEN, yours, &c.

M. N.

FARTHER IMPROVEMENTS ON THE WATER TRAP.

To the Editors of the
GLASGOW MECHANICS' MAGAZINE.

GENTLEMEN,—It seems to be a prevalent opinion, that the effluvium rising from common sewers, through the gratings, in this and other large towns, is injurious to health—which opinion is probably well-founded. The question then is, what is the most simple and effectual contrivance for preventing it? and, at the same time, allowing the water from the gutters to fall freely into the sewers?

Simplicity and durability is absolutely necessary in things of this nature—they must not be liable to go wrong, nor even to be put wrong. Without saying any thing on the plans that have been proposed, I submit the following to those who take an interest in the improvement—than which at least I can conceive nothing more simple.

A, B, C, D, (fig. 9,) is a curved trunk, or tube, open at both ends; A, B, is the grating covering its upper end, with which the lower end makes an angle of 45 or 50 degrees, and which is provided with a valve, C, D, having hinges, with a tail, so as to clear the outlet entirely, when raised to prevent straw or other matter from lodging about the joint. This valve, by reason of its angular position, bears on the end of the tube with about half its own weight, and is thereby kept close when once accurately fitted. The weight of the valve may be easily adjusted to sustain the pressure of a small quantity of water, suppose to the level of E, F; but, when the water, by running through the grating, rises a little higher to G, H, it will raise the valve and fall into the common sewer. It will be observed, from the position of the valve when open, and the form of the tube, that nothing can possibly lodge to prevent it from falling close on the orifice when the water ceases to flow through the grating. The hinge, or joint of the valve, ought to be brass, to prevent stiffness from rusting.

It is a pity that the inhabitants of large towns should be assailed by noxious vapours for want of such a simple apparatus. Indeed, except the valve, it is no more than a plain cast-iron water-way; which, for its very look, would be a great improvement, instead of the dirty rubbish of stones seen at present through the gratings. If those whose duty it is to remove nuisances, and promote the health and comfort of the inhabitants, thought of adopting the improvement, their best plan would probably be to make trial of one of each of the two most approved that have been suggested; and, after deciding which was superior, they could with more confidence bring them into general use.

G. M.

Glasgow, 2d Feb. 1825.

ON THE MODE IN WHICH THE SYPHON ACTS.

To the Editors of the
GLASGOW MECHANICS' MAGAZINE.

GENTLEMEN,—Having observed, in a former Number of the Magazine, a remark concerning the usual explanation given of the action of the syphon, implying that it is not quite convincing, I offer the following, which will be found to be more satisfactory—although the usual explanation certainly shows that an equilibrium does not exist, and therefore motion must take place.

Let A, C, (fig. 10,) be a vessel filled with water to A, B. D, E, F, a syphon; and, for simplicity, let the column of water, D, E, or E, L, be equal to the atmospheric pressure, and let G, D, and F, K, be two columns of atmospheric air, of the same diameter as the syphon. Then the atmospheric columns G, D, and M, K, support the columns of water D, E, and E, L. There remains, therefore, only the atmospheric column M, F, to support the column of water F, L; and, of course, F, L, will preponderate, and its place will then be occupied by another quantity of water, and a continuous flow will succeed.

The same reasoning will apply when the columns of water, D, E, and E, L, are less than the atmospheric pressure. For the excess of the pressures of the columns, G, D, and K, M, above D, E, and E, L, being equal, and acting in opposite directions, destroy each other's effects, and hence the result must be the same as before.

A. B.

Dollar, 28th Jan. 1825.

TAXIDERMY;

OR,

THE ART OF PRESERVING OBJECTS IN NATURAL HISTORY.

THE art of preserving animals has received the name of *Taxidermy*—being composed of two Greek words, *ταξις order*, and *δερμα the skin*.

There is nothing better calculated to refresh the memory, to furnish standards with which newly discovered objects may be compared, and to excite an interest in the study, than a collection of objects in Zoology well preserved. No mere verbal description, however accurate, is sufficient to convey a correct idea of the characters of an animal. Many relations of parts, and many gradations of form, may be perceived by the eye, which words are unable to express. Even drawings fail in conveying an accurate idea of the form and other external characters. Coloured drawings of animals are eagerly sought after. Yet how seldom are they accurate; and, even when they are, they form the least important character that is employed. Besides, there is a great risk of errors being introduced in the course of the engraving, in order to suit professional taste.

The art of preserving animals is of recent invention, having only made any progress during the last 60 years. The first writer on the subject was the celebrated Reaumur, who published a memoir on the method of preserving skins of birds to be sent to a foreign country. It was sufficiently simple. Having received the bird preserved in spirit of wine, he contented himself with taking it from this liquor, and introducing two ends of an iron wire into the body behind the thighs. He then fastened the wire to the claws, fixing it in a small board, and put two black glass beads in the place of eyes, and called it a stuffed bird.

The next improver of the art was Schœffer, who, after skinning the bird, contented himself by cutting the birds longitudinally in two, and filling one half with plaster. He then fixed the skin to the back of the box, stuck in an eye, and represented the beak and claws by painting. This method is still followed in Germany, though much improved.

The next that we have to mention is the Abbé Manese, whose work appeared in 1786. Though not the inventor, he was the first that recommended, in print, the method of preserving animals which we at present pursue. The principal objection to his plan is, that he adopted the use of alkalis for the purpose of destroying insects. There is no doubt but that they may fulfil the purpose of preservation, but they are very apt to deliquisce and attract humidity, to such a degree, that in wet weather the bird is kept in a damp state, which must soon prove destructive to the beauty of the plumage and even to its existence.

Manduyt followed him, in a memoir on this subject, in the Encyclopedie Methodique. The rules he has laid down are of considerable importance, being an improvement on the plan of the Abbé. He has not, however, pointed out any means of preservation, with the exception of employing sulphurous fumigations for the purpose of killing destructive insects. This, however, is a pernicious process, injurious to the specimen, the skin in many places wrinkling, or being destroyed, and the colours of the feathers suffering important changes.

In 1802, Fontenelle published a paper on this subject. The plan he proposes, however, is too tedious. The only preservative he recommends is the oil of turpentine. This, however, is found not to answer the purpose, the feathers, unless they are soaked in it, soon becoming affected with insects; and even when it succeeds, the preservation is always at the expense of their colours, the feathers soon absorbing the turpentine, and becoming tarnished.

The last foreign author we shall notice is M. Dufresne, whose small work on Taxidermy has been translated into English, and gone through several editions, being by far the best on this subject.

There are but few writers on Taxidermy in our own language. There is a small tract by Mr. Swainson, of Liverpool, of no great merit. There are also several judicious remarks in Dr. Fleming's Philosophy of Zoology.

Instruments and other Articles.

1. An assortment of softened iron wires. 2. Flax or tow, or the ends of untwisted cords. 3. Scalpels, scissors, and forceps. 4. Pincers of different kinds. 5. Hammer. 6. Two files. 7. A collection of eyes. —As for

Preservatives,

different substances have been proposed. Mr. Warrington recommends a solution of corrosive sublimate in spirit of wine, to be brushed over the inside of the skin, and over the feathers. Although this is effectual in preventing the attacks of vermin, it does not secure against the progress of putrefaction until the specimen is dried. To remedy this evil, some applied it in the form of a dry powder, mixed with equal parts of burnt alum and powdered galls. This serves both as a security against insects, and also facilitates the drying of the specimen; and, when it is completely dried, it may bid defiance to insect foes. Quantities of musk and camphor are sometimes added. But they may readily be dispensed with, since they are not necessary to the future preservation of the specimen, and they add materially to the expense.

Arsenic, however, has in a great measure superseded corrosive sublimate, since the latter is found to destroy the wires employed in preserving the form of the specimen. The best form in which it can be used is in that of the arsenicated soap.*

In the chace, a double-barrelled gun is to be preferred: one of the barrels loaded with small shot, for the little birds; and the other with large shot. The former ought also to be loaded with much less powder than the latter. When the animal is shot, we ought to sprinkle some dry dust on the wound, and introduce some lint into the mouth, to prevent the feathers being soiled with the blood. We are then to allow it to remain undisturbed till it is cold, and then convey it home, disturbing the feathers as little as possible. When the animal is obtained alive, we are to kill it by pithing—*i. e.* introducing a sharp instrument between the skull and the first vertebra, so as to divide the spinal marrow. In small animals the puncture of a needle will be sufficient. In summer, the animal should be skinned on the day

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*	
White oxide of Arsenic Soap	each 2 lb.
Salt of Tartar	12 oz.
Quick-lime	4 oz.
Camphor	5 oz.

The whole beat up into an uniform mass. To be dissolved by water, and applied by means of a common brush. This is the application employed in the Museum of Paris.

that it is shot. In winter, however, it may be deferred for several days.

Skeletons.

Before taking up the preservation of the bones or the solid parts of animals, we may mention the method for making skeletons.—They are of two kinds: natural and artificial. The former is particularly employed for the smaller animals—*i. e.* of the size of the fox and under. The animal is to be skinned, separating the head only, that the brain may be cleaned out. The bones are then to be cleaned of the flesh, carefully preserving the ligaments. They are then to be allowed to macerate for two or three days in lime-water. It is then to be taken out, and any flesh that may have remained on is to be cleaned away. The skeleton is then to be supported in a proper position; and, when dry, it will be found that the ligaments which fasten the bones to one another will be sufficiently strong to keep the skeleton upright.

Artificial skeletons are formed in nearly the same way, except that they are to be allowed to remain longer in the water, in order that the ligaments may have time to putrify. They are then to be connected by means of wires, and set up in a proper position. In order to make natural skeletons of some of the smaller animals, we sometimes take advantage of the labours of insects. Thus mice and small birds may be placed in a small box, perforated with numerous holes, near an ant-hill, when the ants soon clean away all the fleshy parts, leaving only the bones and connecting ligaments. They may afterwards be macerated in clean water to remove the blood, and then whitened by means of lime or alum water. In like manner the same process may be performed by the wasps, placing the subject flayed, smeared with honey or sugar, near one of their nests, when they will set to work, and clean it often in two or three hours.

Preservation of the Skins of Quadrupeds.

Here we are to commence with making a longitudinal incision in the belly, sufficiently large to admit of the body being taken out. The posterior extremities are to be separated at the articulation of the hip joint, and the tail disengaged at the rump. The skin may now be reversed, pulling it over the body towards the head, separating in its course the fore-legs from the body at the first joint, and the ears at the base. The carcase is then to be disengaged from the head at the atlas, and removed. We are then to remove carefully the flesh from the different bones that remain, and the brain is to be scooped out through the foramen magnunteral wire. We are now to commence stuffing, filling up all the vacuities with tow, and the incision is to be sowed up. The animal is now to be fixed on a board, and pressed into a suitable form and attitude.

When the animal is of a larger size, a frame of wood should be constructed of the shape of the animal, and the skin cautiously stretched on it, the intervals being filled up with tow or straw.

X. X. X.

Glasgow, 10th Feb. 1825.

(To be continued.)

A NEW MODE OF FORMING ARTIFICIAL FILTERS.

As the inhabitants of Paisley are at present much interested in discovering the best mode of filtering the water of the Cart, for the purpose of supplying the town, it may be useful to make a few observations on this subject. We do not know whether they have any prospect of obtaining a natural filter, but in case they do not obtain one, great care must be taken in the plan adopted for forming an artificial one, otherwise they may throw away a great deal of money in forming works which will be found, after a very short trial, to be of little or no use. This was fully examplified in the works at first erected both by the Glasgow and the Cranstonhill Water Companies of our city. A great deal of unnecessary, and, as it ultimately proved, unavailing labour and expense was thrown away by both these companies; and it will be well for the good people of Paisley that they take warning by previous example, and avoid adopting plans which must inevitably fail.

From all which has come under our observation, and we have seen not a few artificial filters in our day, it seems as if it were almost impracticable to form an artificial filter which will continue to be useful for any length of time. However excellent they may at first appear, and however well planned they may apparently be, we have invariably found, that, after a short time, they have become all equally useless; they get dirty and choked up, and cease to purify the water as they at first did.

This is certainly much to be lamented; and when we consider the absolute necessity of large quantities of pure water to supply large cities, and often the impossibility of obtaining it by means of natural filters, it becomes highly necessary to inquire whether it be not possible to construct an artificial filter, which will remain clean, or rather will clean itself from impurites, as a natural filter does. In investigating into this matter it is best to observe the mode in which a natural filter of water from a river is formed, and as near as practicable to adopt this plan, in forming an artificial one. We find, then, that natural filters are formed by sand banks, which occupy a portion of the bed of the river and its adjoining banks. The waters of the river flow over that part of the sand which form its bed, and filter down through it; and the sand is kept constantly clean, as it is washed by the water which flows over it, and by the continual removal and renewal of the sand which is on the top, where the chief portion of the impurities gather. When we wish to use such a natural filter, wells are dug, and tunnels formed in the adjoining banks, below the level of the bed of the river, and the water flowing from the river down through the sand into these, is found freed from all impurities, while, as we have already stated, the water of the river washes the top of the filter, and keeps it constantly fit for use.

The general plan of forming artificial filters, is as unlike this as possible. Large and expensive tanks are formed, these are filled with sand and stones, and the water is made to filter through them laterally; they very soon become filled with impurities from the water, and as no means is, or, indeed, can be used to keep them clean, as in the natural filter, they soon become filthy and useless. In the natural filter, the waters of the river flow over it and keep it clean: in the artificial filter, the water flows laterally, and no water enters but that which is to be purified. Now, it is quite clear that so long as we follow plans so very opposite to the one pointed out by nature, we never can expect to construct an artificial filter which can be of the slightest use for any length of time.

If, however, we were constructing an artificial filter, and if the inhabitants of Paisley require to make one, we would advise them to follow our plan; we would excavate a considerable portion of the bed of the river and of its adjoining bank, on the side where we wished to sink our well; we would build our tunnels and our well in this excavation, and would then fill the whole with sand, allowing the waters of the river to flow over this artificial sand bank, to wash it and to filter through it, as it does in the natural one; we would thus have a filter which might indeed be called natural, and which would never cease to be useful.

We know that the schemes of projectors are too often but little attended to, by those to whom they are addressed; but if the inhabitants of Paisley require to construct an artificial filter, we beg them to take what we say, not as the scheme of a projector, but as the advice of practical persons well acquainted with the subject. Had the Cranstonhill Water Company, when they erected their filters at the top of a hill nearly two miles from the river, made one such as we have described, in its bed and on its north bank, they would have had a constant supply of pure water, at far less expense than their works at Cranstonhill cost them, and they would not have been obliged to abandon it, as they were the works which had been so expensive.

We are not ignorant that in constructing many filters, the water has been made to flow down through the sand; but in these no body of water has ever been made to flow over the top, as in the natural filter. They are thus so far the very same as the lateral filters, no water passing over them but what is to be purified, so that there is no means of cleansing the one more than the other, except emptying the filter entirely, and removing the impurities which it has gathered.

In concluding, then, our advice in constructing filters is—never to make the water flow laterally, or upwards through the filter, but always downwards; and to have the top of the sand-bed which forms it, washed by the waters of the river.

ON THE ORIGIN OF THE STOMACH SYRINGE.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—Having observed, in one of the newspapers, some discussions between Dr. Ure and Mr. Jukes, respecting the apparatus for removing poison from the stomach, I take this opportunity of mentioning that the merit of the discovery belongs to neither of these gentlemen. The plan is as old as the days of Boerhave, that celebrated physician having proposed a similar instrument. It never, however, came into general use; till, having undergone several important improvements, it was brought again into notice by M. M. Dupuytren and Renault. The instrument is thus described by the latter gentleman, in a small work by Orfila, entitled, "*Secours a donner aux personnes Empoisonnees ou Asphyxiees.*" (1818.) "The instrument consists of an elastic gum tube, the end which is introduced into the stomach, having two slits at the sides, and closed at the point. To the other extremity there is a brass or ivory virol attached, receiving the point of a syringe, which is connected with it by means of a screw. By this means I have been enabled to inject seven or eight ounces of water into the stomach of a dog, and in a few seconds draw it back again, with the poison which the animal had been made to swallow previous to the experiment."—page 13.

It is true that Mr. Jukes' instrument may be somewhat different from this; but it is only in being more complex, and therefore more apt to be deranged. As for Dr. Ure, it may be true enough that he brought some of these elastic gum tubes from Paris; but that he can have any pretensions to be considered the inventor or proposer of the instrument, is just as absurd as if a person were to purchase a steam engine, and then pompously announce that to him belonged the merit of the invention; or take up some principle, known to chemists for half a century, such as the saturating point of an acid by means of an alkali, and call this a new discovery, and the graduated glass in which the mixture was made an alkalimeter. Besides, I would wish to know in which of his classes the Doctor mentioned the proposal he alludes to. We are acquainted with several gentlemen who have attended his classes, and they only recollect that he stated that the tubes were brought over by him from Paris, and that he found them very useful in his gasometers.

In concluding, I would notice an instrument intended to serve the same purpose, first proposed in a most useful little work, "On Poisoning and other Accidents."* In this case, the tube is exactly the same as that proposed by Mons. Renault, except that it is provided with a stop-cock, near the extremity where the syringe was formerly attached. Instead of it, an elastic gum bag, such as that used in the operation for Hydrocele, also provided with a stop-cock, is screwed on. In the use of this instrument, the elastic gum tube being introduced into the stomach, the bag of caoutchouc, or elastic gum, filled with tepid or cold water, is to be screwed on. The stop-cocks are now to be opened, and the contents forced into the stomach by means of pressure. When you wish to withdraw it again, you have only to allow the bag to expand, when it will suck up the injected fluid, along with more or less of the poison, in a diluted state. The stop-cocks are now to be shut, the bag unscrewed, its contents replaced by fresh water, when the same process is to be repeated. In this manner, in a few minutes, you may wash the stomach clean, whilst it would require upwards of a quarter of an hour with Mr. Jukes' apparatus. It also recommends itself for its cheapness, and in not being liable to be deranged, being always ready for use.

I am, GENTLEMEN, yours, &c.

C. R.

Glasgow, 7th Feb. 1825.

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[*] Lumsden and Son. 12mo. 1821.

BUFFON & GOLDSMITH *VERSUS* PHRENOLOGY.

A MOST extraordinary conflict of opinions is discovered on contrasting the writings of Phrenologists with those of M. Buffon and Dr. Goldsmith, as will be perceived from the following excerpts:—"That so large a brain as man possesses, is not necessary to mere animal life, we may infer from this, that many animals have scarcely any. Nature, we are sure, would not have given this in so large a volume if a smaller would have served. What then are we to infer from its magnitude? Are we not, in some degree, directed to the answer by the undisputed fact that animals are generally intelligent in proportion to the size of their brains; and that man, who surpasses them all in intelligence, has the largest brain of any animal of the same dimensions? It is reasonable, thence, to conclude, that the brain is somehow connected with the mental powers, and that its size is some indication of their perfection and vigour." This is the doctrine set forth by Phrenologists; now, contrast with which what Dr. Goldsmith, in his Treatise on Amphibious Quadrupeds, says on the subject:—"It has been often remarked, that all animals are sagacious in proportion to the size of their brain. It has, in support of this opinion, been alleged, that man, with respect to his bulk, has, of all others, the largest. In pursuance of this assumption, some erroneous speculations have been formed. But, were the size of the brain to determine the quantity of the understanding, the seal* would, of all other animals, be the most sagacious; for it has, in proportion, the largest brain of any, even man himself not excepted. However, this animal is possessed of but very few advantages over other quadrupeds; and the size of its brain furnishes it with few powers that contribute to its wisdom or its preservation." In his description of the Ourang Outang, or Wild Man of the Woods, he farther observes: "The face of this animal is like that of a man, the forehead larger, the head round, and the brain formed in the same manner with that of man;" from a picture so like that of the human species, we are naturally led to expect a corresponding mind; but so far from this being the case, the learned Doctor tells us that this creature "wants reason:"—an evident proof, as Mr. Buffon finely observes, "that no disposition of matter will give mind, and that the body, how nicely soever formed, is formed in vain, when there is not infused a soul to direct its operations."

J. T.

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* "The conformation of whose head is round, like that of a man."

* * *

NEW AUGER.

A NEW constructed auger has been lately invented by Dr. Church of Birmingham, for which he has obtained a patent; we shall, therefore, particularly describe its form and the mode of making when the specification is enrolled; but we cannot avoid mentioning in this place its extroardinary merits, which so much exceed every other kind of auger or boring tool that we are acquainted with, that we should certainly not have given full credit to a report, had not our own hands and eyes been the means of communicating the facts to our senses.

This improved auger, (indeed we have seen several of different sizes, but the most perfect one we now refer to,) is one inch and one-eighth in diameter. We first tried its effects upon a piece of dry deal four inches thick, held in the left hand without any other support, and turning the auger by the right hand in the way that gimblets are usually turned, passed the auger through the four inch deal in fifty seconds. With the assistance of a bow, it was made to penetrate through a post of seven inches square in twenty-one seconds, and in the hand of an expert workman, there is no doubt but that its progress would be much more rapid. It cuts a perfectly smooth hole, and clears itself as it advances.

The utility of an auger possessing such superior advantages to shipwrights, as well as a variety of other artizans, must be immediately obvious; and one circumstance which renders it still more valuable is, that its form is such that it can be sharpened from time to time upon an ordinary grindstone, without in the slightest degree altering its figure; indeed it will retain the same form and properties even though ground down to within a short distance of the stem.

Not having the inventor's permission, we refrain from publishing a particular description of this instrument; but as soon as the specification is enrolled, which will be in May, we propose to ourselves the pleasure of presenting it to our readers in a more perfect state.—*London Jour. of Science and Arts.*

ON THE CAUSE OF HEAT PRODUCED BY FRICTION.

To the Editor of the
American Journal of Science and Arts.

Dear Sir,—I have made some attempts to explain the cause of the heat excited by friction, an account of which I hope will be acceptable to you.

In rubbing two bodies together, it is evident that the air in their pores and interstices will be compressed, and as air readily yields heat by pressure, it is possible that the heat excited by friction may be thus explained.

If two substances were rubbed together, and if, at the same time, there could be similar friction in vacuo, by a comparison of the results an opinion might be formed of the effect of air with friction in exciting heat. I mentioned this explanation to Professor Renwick, and Dr. M'Neven; they thought it probable, furnished air-pumps, and assisted in making experiments.

A wooden spindle was fitted to a socket, and a similar spindle also fitted to a socket within the receiver of an air-pump, these were connected by a brass rod, passing through a collar of leather, and being quickly turned by a cord, heat was readily excited; several trials were made, in all of which, except one, when the density of the air was diminished, less heat was excited. In that, about fourteen-fifteenths of the air was exhausted—notwithstanding this, the heat was greater within the receiver than without. In this instance, pressure was applied as far as could be, and allow the spindle to turn rapidly, the experiment was afterwards repeated with the same apparatus and gentle pressure, and the heat was much greater without the receiver than within.

Upon considering all the experiments, there appears reason to believe that air assists in exciting heat by friction, and the question arises, is it wholly by compression, or is there any other cause?

If the experiment should be repeated it would be well to ascertain that the spindles excited equal heat—that time be allowed for the air to leave the pores of the wood—and that the density of the air in the receiver during the experiment be noted.

Respectfully, yours,

James T. Watson.

New-York, 8th May, 1824.

PROFESSOR ANDERSON & DR. BIRKBECK.

[Having already devoted so much of our pages to the discussion of this question, we are unwilling that it should not be satisfactorily settled, previous to our giving it up. We have, therefore, inserted Mr. Barclay's letter and those extracts from what appeared in the Free Press, which we conceive of importance to the subject. Mr. Barclay says in his letter, that Mr. Hart has not met him on the merits of the question. But we conceive Mr. H. did not mean to do so, but having been referred to by Mr. B. in a previous letter, came forward merely for the purpose of giving a statement of what took place so far as *he* was *concerned*.—See p. 443, Vol. II. col. 1.]

To the Editor of the
GLASGOW MECHANICS' MAGAZINE.

GENTLEMEN,—I observe in last Saturday's Magazine, a letter from Mr. Robert Hart, on the subject of Dr. Birkbeck's claim to the formation of classes for the scientific education of Mechanics. Mr. Hart himself, I am certain, does not imagine that he has at all met me on the merits of the question; yet as a name has been given, your readers will find that in next Saturday's Free Press, I shall have fully redeemed my pledge, to substantiate my position. I have chosen this channel of communication, as my proofs will be bulky, and I conceive, (as yourselves have hinted,) that your columns may be better applied. As the controversy, however, has arisen in your work, I leave to yourselves to make use of such of the documents I shall lay before the public, as you may deem to bear the most on the dispute. I hope to be no farther troubled in the matter; but at all events I trust that if any thing farther is to be said, the remarks on both sides may be better tempered with that spirit of charity which science should ever engender. Wishing you every success in your labours, I remain,

Your's, &c.

HUGH BARCLAY.

Glasgow, 2d Feb. 1825.

APPENDIX.

No. I.—*Statement by Messrs. Alexander Robertson and Daniel Black.*

In the year 1800, we called on Dr. George Birkbeck, then Professor in Anderson's Institution, respecting a question we wished explanation upon. After giving his opinion, he mentioned his desire to do something for the instruction of the Mechanics of Glasgow; whom he described as a very useful class of the community. He requested us to call back upon him when he should have bills ready for distribution. We called back, and according to his desire, we distributed the bills amongst the workshops, mason sheds, &c. At the beginning of the course, there were a thin attendance, but which increased towards the conclusion. The course was gratuitous; and at the end of it, or of the second course, a silver cup was presented him, being delivered, in presence of the Class, by John Roberton, Engineer. The second course, next winter, was crowded, and a fee of 1s. was charged to pay the operator and charges. Whilst Dr. Birkbeck was absent from Glasgow, the third course was commenced, and a fee of 5s. exacted by the Directors. On the Dr.'s return, he remonstrated at the charge being made, and the charge was reduced to 2s. 6d. We attended the whole three courses, and are perfectly satisfied with the fact, which must be known to all concerned, that Dr. Birkbeck was the first who commenced the Mechanics' Class; and that neither in the College, nor Anderson's Institution, were there any Class where the Operative Mechanic could obtain instruction at a cheap rate, and suitable hours, until Dr. B. commenced his course, as before mentioned, in 1800. In the Session 1822-23, we came before the Mechanics' Class, and stated the above facts, when a Committee was named, of which we were Members, and Dr. Ure, Convener; when, after examining the Will of Professor Anderson, and the Sederunt Book of the Managers, the Committee (of which Messrs. Hart and Watt were Members,) were unanimously of opinion that Dr. Birkbeck was the founder of the Class, and the Members being of the same opinion, an address was prepared by Dr. Ure, and subscribed by the Class.

ALEXANDER ROBERTSON, Pattern-Maker, Gorbals.
DANIEL BLACK, Teacher of Mathematics, No. 76, Hutcheson-Street.

Glasgow, 31st January, 1825.

We attended Dr. Birkbeck's first two courses to the Mechanics of Glasgow, in 1800 and 1801, since which we have, with little interruption, been Members of that Class; and we do confirm the truth of the statement of Messrs. Robertson and Black.

WILLIAM MURRAY, Manager, Claud Girdwood & Co.'s.
JOHN SCOTT, Wright and Builder.

2d February, 1825.

No. V.—*Address to Dr. George Birkbeck, (drawn by Dr. Ure and the Committee, whereof Mr. Robert Hart was a Member.)*

SIR,—We, the Members of the Mechanics' Class, Anderson's Institution, Glasgow, impressed with a deep sense of the benefits resulting from the course of lectures for instructing artizans in the scientific principles of the arts and manufactures, beg leave, in this respectful manner, to tender our grateful recollections to you, by whom that plan was first projected and carried into execution.

* * * * *

It was your distinguished lot, Sir, to lay open more widely than had been previously contemplated, the portals of philosophy, and to invite artizans, of every description, to enter them, however scanty their means, or obscure their condition.

For this truly philanthropic deed, we present you thus publicly with our most heartfelt thanks; and, while from your approving conscience you will derive the purest satisfaction, you will not disdain the homage now offered you, after an interval of nearly 20 years, by the Students of that Class which you first called into being.

With every kind wish for your prosperity and happiness, we subscribe ourselves,

Sir, your most obedient Servants,
(Signed)
Francis Jenkins, President of the Committee of the Mechanics' Class for 1822-23.
William Murray, Vice ditto.
Hugh Barclay, President of the Mechanics' Class for 1823-24.
Ninian Purves, Vice ditto.
And about 400 others.

No. VI.

We have attentively read the article subscribed B., in No. LIV. of the Glasgow Mechanics' Magazine, and having been Office-Bearers of the Mechanics' Class in the year there alluded to, we declare that the facts therein stated are all true, and as Members of the Committee, we do solemnly deny that we ever dictated to, or interfered with, the Committee for managing the memorial to Dr. Birkbeck; and that Committee must be grossly defamed if it is alleged they acted, or were capable of acting, at our instigation. We have been long Members of the Mechanics' Class, (some of us upwards of twelve years,) and from all we know and have heard, are satisfied that the merit of originating the Mechanics' Class belongs to Dr. Birkbeck, and he alone.

(Signed)
Francis Jenkins, Preses.
William Murray, Vice-Preses.
William Warren, Treasurer.
John Ross, Secretary.
John Liddell, Assistant Secy.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—Averse as I am to controversy, and inconvenient as it must be to a mind occupied, as mine is, by professional duties, your having permitted my name to appear, treated as it is, so unceremoniously in your publication, Nos. LV. and LVII. Vol. II. leaves me no choice. I cannot, therefore, avoid shortly replying to the groundless insinuations of the anonymous Aliquis, and the equally groundless charge of Mr. Robert Hart.

Whatever my duty obliged me to do, whilst acting as Treasurer for the Mechanics' Class, Anderson's Institution, my conduct, I feel assured, will bear the strictest scrutiny; I shall, therefore, not trouble your readers with any defence, farther than the *mis-statements* of Aliquis, which carries refutation upon their very face, affords. It was never intended I should conduct a Mechanical Drawing Class in the Mechanics' Institution, not being a Teacher of Mechanical Drawing. I was indeed appointed to deliver a Course of Lectures on the Theory and Practice of Drawing, as connected with the various branches of the Art. Why those Lectures were not delivered, is known to those whom it concerned, amongst which Aliquis cannot rank himself, and *is therefore entitled to no farther information on the subject.*

The paragraph he preludes with Warren & Co. is a gratuitous effusion, which he endeavours to give authenticity to by adding an interpolation of the 15th Rule, which, being printed with the Catalogue of the Mechanics' Class Library, Anderson's Institution, 1822, your readers can, by comparing, ascertain the credit due to the statement of Aliquis. I have read, several times, what has been printed as a copy of Dr. Anderson's Will: I have it not now by me to compare, but my memory fails me very much, or Aliquis has stated new matter. His assertion, however, *is of such a questionable nature,* that replying farther would be as unnecessary to your readers as it would be useless to him.

I regret much to see Mr. Robert Hart place himself in such a situation; for, if he establishes what he states, and I deny that I dictated to him the portions of the Will which he read to the Class, and that I successfully deterred him, and the respectable Committee with which he acted, from freely expressing their opinions and belief, what becomes of his firmness in the discharge of a public duty? If I did not interfere in the matter but in public, like any other individual of the Class, which I affirm and can prove was the case, what *claim* has his statements upon the attention of your readers? In duty to myself, and with due deference to the opinion of society, I have thus been forced to trespass upon my time, and the attention of your readers.

In concluding, I beg leave to add my belief with respect to who was the founder of the Mechanics' Class, a belief, strengthened by what Mr. Hart and the gentlemen with whom he acted, appointed to investigate the matter, declared, as the result of their research; Dr. Birkbeck established, in 1800, the Mechanics' Class, and Dr. Ure commenced the Mechanics' Library in 1808.

With all due respect to the memory and benevolent intentions of Dr. Anderson, I could not, in reading the Will, or in what I heard on the subject, find even the smallest reason to suppose that Dr. Anderson any more contemplated the establishment of a Mechanics' Class in his Institution, than the New Town Building Company, when they erected the building for a Market, foresaw that it would become Anderson's Institution.

I remain, GENTLEMEN,
Yours, &c.
WILLIAM WARREN.

Glasgow, 156, George-Street,
Feb. 4th, 1825.

To the Editors of the
GLASGOW MECHANICS' MAGAZINE.

GENTLEMEN,—As the statement that I gave in your Magazine of what took place in Anderson's Institution, about the Birkbeck memorial, has been contradicted in the Free Press, previous to replying to that paper, I send, for your first Number, the following attestation.

Yours, &c.
ROBERT HART.

Glasgow, 8th Feb. 1825.

SIR,—The statements that you have given in the Mechanics' Magazine, No. LVII. about what took place with the Picture Committee, of which we were members, is perfectly correct.

(Signed) DAVID COOK.
ALEX. ROBERTSON.
DANIEL BLACK.
A. WATT.

To Mr. Robert Hart.
Glasgow, 8th Feb. 1825.

USEFUL RECEIPTS.

1. *To make Sugar-of-Lead.*

Boil ceruse, with distilled vinegar, in a leaden vessel, until the vinegar becomes sufficiently sweet—then filter the vinegar through paper, and after due evaporation set it to crystalize.

D. M. B.

2. *Method of preserving Oranges and Lemons.*

Take small sand, and put it into an oven to dry; after it is cold, put a quantity of it into a clean vessel, on which set a laying of oranges or lemons, the stalk-end downwards, so that they do not touch each other, and strew in some more of the sand, as much as will cover two inches deep, and so on till filled; then set the vessel in a cold place. By this means they may be had in perfection at any season of the year.—J. T.

3. *To improve the Flavour of Malt Spirits.*

The flavour of Malt Spirits is said to be highly improved by putting three ounces and a half of finely powdered charcoal, and four ounces and a half of ground rice, into a quart of spirits, and letting it stand during fifteen days, frequently stirring it; then let the liquor be strained, and it will be found nearly of the same flavour as Brandy.—J. T.

4. *To purify Zinc.*

Melt Zinc with a heat no greater than is sufficient to keep it fluid. Stir it strongly with an iron rod, and throw in alternately pieces of sulphur and tallow—the first in largest quantity. If any scorea forms on the top, take it off, and continue the process until the sulphur is found to burn freely and totally away on the fluid zinc.—R. P.

QUERIES, AND ANSWERS TO QUERIES.

SELF-ACTING PUMP.

GENTLEMEN,—In the Mechanics' Magazine, No. LVI. Vol. II. (for Saturday, 22d January, 1825,) there is a sketch of a Self-acting Pump (Fig. 2,) on the Plate. I have occasion to irrigate a piece of meadow, through which a burn runs in a channel about five feet deep, which, from the levelness of the adjacent grounds, cannot be damed up more than to give it a fall of two and one half feet, and the water that could be got raised would require to be lifted at least ten feet from the bottom of the burn.

Query.—Could the above pump be applied to such a situation? and, if it could, what size would it require each particular part of the pump to be to accomplish this? and what quantity of water would be necessary to run into the cistern A?

If the above pump is not suited for such an operation, could any of your Correspondents inform me of a plan suitable to such a purpose?

If the Self-acting Pump would work in such a situation, the upright bore H would require to be eight inches diameter.

IRRIGATOR.

Crieff, 7th Feb. 1825.

ECHO IN CHURCHES.

GENTLEMEN,—It is generally known that the echo in some Churches is extremely disagreeable. The one with which I am connected is 32 feet by 42, and 24 feet high, and the echo is almost intolerable. Would any of your able Correspondents put us upon a plan to get rid of this nuisance? I may mention, that the pulpit is situated at one end of the Church. A speedy paper on this subject would much oblige,

GENTLEMEN, yours, &c.
NOMIS.

Cupar, 2d February, 1825.

SODA-WATER.

GENTLEMEN,—Could any of your Scientific Correspondents inform me of the cheapest and best mode of preparing Soda Water?

D. FRASER.

Boleskine, 1825.

Queries for Builders Answered.

GENTLEMEN,—In No. LVI. Vol. II. page 431, you have some queries to Builders. My opinion is, that an 18 inch wall of brick is equal to one of stone of 24 inches, either built as ruble or ashler; and in the same proportion with all the other thicknesses. Parapet, if well built, I think is as good as brick with the same thicknesses, or even better than brick.

You wish also to know whether the ends of joists ought to be fast or not? If the floor is not to be much shaken, such as by dancing, they will be better fast; if to be shaken, it will be better for the walls that they be loose at the ends; but the walls will need to be studied by some other means—say a joist kept out of the reach of the flooring deals, and placed at every third joist, the ends of *it* made completely fast in the walls.

A MECHANIC.

Glasgow, 8th Feb. 1825.

NOTICES TO CORRESPONDENTS.

We have received communications from G. M., Mechanicus, R. F., &c.—We refer P. T. to page 480 of Vol. I. of that excellent and useful work of Dr. Crell's, "The Family Oracle of Health." We are not thoroughly versant in the matters referred to by J. P., but doubt not he will find a good answer to his question by referring as we recommend.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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Communications (post paid) must be addressed.

CURLL, PRINTER.

THE GLASGOW MECHANICS' MAGAZINE,

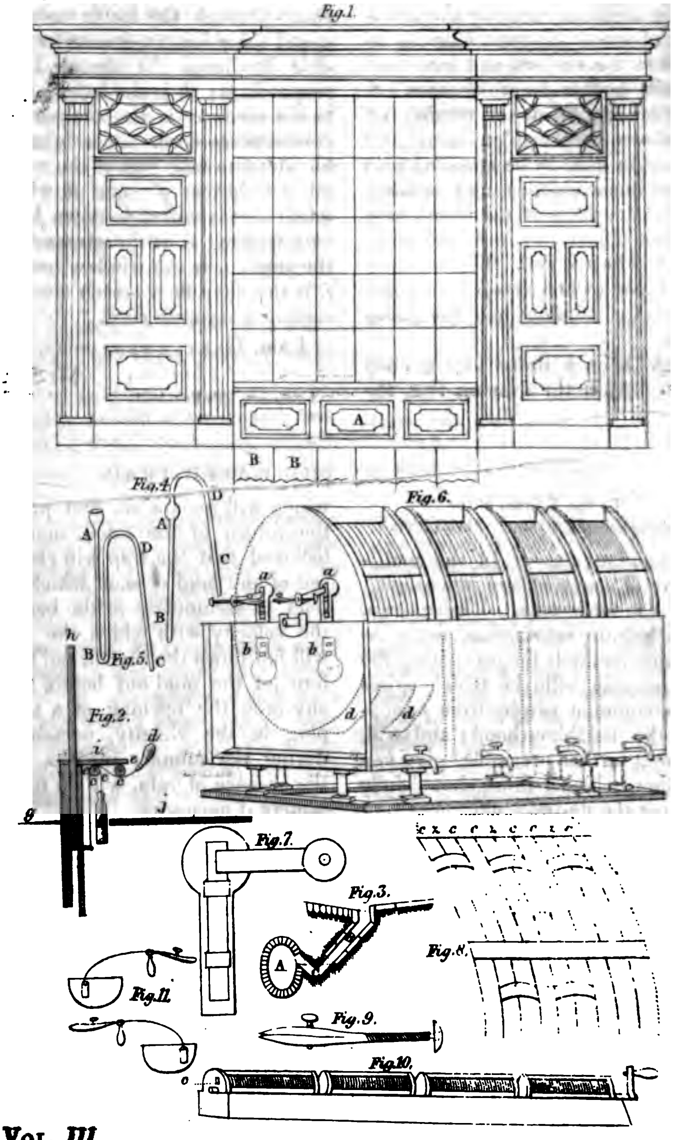
CONDUCTED BY

A Committee of Civil Engineers and Practical Mechanics.

> " All is the gift of Industry; whate'er
> Exalts, embellishes, and renders life
> Delightful." *Thomson.*

No. LX. *Saturday, 19th February,* 1825. Price 3*d.*

IMPROVED WINDOW, WATER-TRAP, IMPROVED SYPHONS, &c.



Vol. III.

— Swan Sc —

IMPROVED WINDOW.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—If you should think the annexed design for a shop front, worthy of a place in the Glasgow Mechanics' Magazine, I will thank you to insert it. It may be the means of drawing the attention of some of your Correspondents to the subject, and may lead to still farther improvements. I consider the mode of putting up and down shop window-boards, (at present in use,) to be attended with much inconvenience and trouble. By the adoption of the plan I here propose, I am convinced much of both will be avoided. The window-board, you will observe, slides down below the window and the pavement.

Fig. 1, is a design for a shop front. A, is the framing that the shuts slide behind; B, the shuts below the street, in a frame for the purpose.

Fig. 2, is to show the manner of drawing the shuts up to the window, by means of cords fixed to the shutter. A bottom piece of iron comes through the inside casing at *c*, and there being a groove for it to slide in, keeps the shutter in its proper form; *d*, is the handle fixed to the cord; *e*, is the shelves that conducts the cord. A weight may be added to take part of the weight off the shut at *f*; and it will be found that it will slide down by its own weight; *g*, is the street; *h*, is the shut; *i*, is the window bottom; *j*, is the shop floor—each shut will require a separate cord.

I am, Gentlemen, yours, &c.

M. Saul.

Lancaster, 13th Feb. 1825.

IMPROVEMENTS ON THE WATER-TRAP.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—"In the multiplicity of counsel there is wisdom," says the wise man. I have seen, with infinite satisfaction, many ingenious methods for preventing the disagreeable effluvia which arises from common sewers from annoying the neighbourhood; and will, without farther preamble, give you another, which I think should fully answer the desired end.

A, (fig. 3,) is a section of the sewer; B, the tunnel for conveying the water from the street, which may be done of freestone, in the ordinary manner; C, is the bent part of it, which ought to be done of cast-iron or of stone, and made water-tight with puddle made of clay: the water flowing through the tunnel will fill C to the bend, which will remain so, and prevent the return of the smell, and it is believed that the trap will clear itself of any mud or sand which may tend to accumulate in the bend by the velocity with which the water will fall down the tunnel, and therefore jet the mud out before it: at any rate, the opening of a water-plug in the vicinity, occasionally during the summer months, or in the absence of rain, will do it completely if necessary.

This plan was laid before the Statute Labour Trustees for the city several years ago, and received their approbation, and it was in contemplation to have constructed one for trial; but, so far as I know, it has never been carried into effect.

I am, Gentlemen, yours, &c.

J. W.

Glasgow, 15th Feb. 1825.

IMPROVED SYPHONS.

M. Bunten's Improved Syphon.

THE improved syphon of M. Bunten is shown at fig. 5, where A, B, is the long branch, with a bulb at A, and D, C, the short branch. This syphon requires neither to be blown into, nor any suction. It is sufficient to fill the long branch A, B, and the ball A, with the liquid, and to plunge the short branch C, D, into the liquid to be decanted. The bulb, A, in emptying itself, draws off the liquid in contact with the short branch, and though the bulb itself is partly empty, the flow is unremitting.—See the *Journal de Pharmacie, Avril,* 1824, p. 189.

M. Hempel of Berlin's Improved Syphon.

Another improved syphon by M. Hempel, a practical chemist at Berlin, is shown at fig. 4. It has the same advantages as that of M. Bunten, and is more easily constructed on a large scale. A part of the liquid to be decanted is poured into the funnel A, at the top of the tube A, B, which is fitted into the short branch of the syphon. As soon as the flow commences through the long branch D, C, the tube A, B, is withdrawn, and the flow continues.—*Id. Id.*

DESCRIPTION OF TWO NEW VOLTAIC BATTERIES.

By ELISHA DE BUTTS, M. D. Professor of Chemistry in the University of Maryland.

To the Editor of the
American Journal of Science and Arts.

DEAR SIR,—Perhaps no branch of science is more important at this moment than electricity.

The power possessed by certain galvanic arrangements to elevate temperature to extraordinary degrees, when associated with our present views of chemical theory, renders them justly objects of great interest. But when we reflect upon the phenomena which have resulted from a power which they also possess, to affect the magnetic condition of bodies, we cannot be surprised that so much of the attention of the scientific world is devoted to this department of study. A consideration of the facts developed by the experiments of Oersted, Ampere, Arago, &c. made me desirous to repeat them and to pursue the subject, and as the most remarkable magnetic effects appeared to have been produced by large plates, I endeavoured to construct an apparatus, upon a plan which should not only have that advantage, but also those by which it might be adapted to operations connected with chemical researches, and in relation to both to possess if possible, in a greater degree than any of our galvanic instruments, all those circumstances of mechanical facility that have been found useful in the hands of other experimentalists. My motive for addressing you now, is merely to describe the plan which I have adopted, as I have found it to be eminently useful in relation to the objects to which I have alluded. The result of a series of experiments in which I am engaged shall be communicated to you for a future number.

Eight wheels (see fig. 6,) made of strong pieces of plank, screwed to each other transversely, four feet in diameter and one inch and five-eighths in thickness, are placed upon an axle six inches in diameter, and five feet nine inches in length, having brass gudgeons one inch and a half thick, at each extremity. These wheels are arranged in pairs, each carrying thirty semicircular plates of copper and zinc, thirty-nine inches in diameter. In order to prepare them for the reception of the plates, they are placed about ten inches from each other, and retained in their positions by eight strong pieces of ash, morticed and screwed into their edges, by which they are firmly connected. Five of these cross pieces are indented by a saw, that they may receive the edges of the plates, and keep them at proper distances. Each pair of wheels, charged with the plates, is separated about two inches from the next, as they are all intended to revolve in a cistern with divisions. The plates are counterbalanced by pieces of lead, painted and varnished, attached to the cross pieces on the opposite side of the wheel. The dotted lines, *d*, *d*, indicate the situation of these counter-weights. The cistern is supported by strong pillars of glass—is six feet long, four feet four inches wide, and two feet three inches deep. It is divided into four cells, by three pieces of one and a quarter inch plank, morticed into the bottom and sides, and rising to within four inches of the top of the cistern, for the purpose of permitting the axle to turn freely. The whole is well painted with white lead, and covered with several coats of copal varnish. The plates are arranged as in fig. 6, and the terminating plates of each division are connected by a strap of copper, four inches broad, soldered to their edges. This strap rises from one plate (for example) until it touches the axle, then passes through the wheel in contact with the axle, until it passes through the opposite wheel; it then dips down to join the edge of the first plate of the next division, which is in a different electrical state. In order to enable the operator to experiment conveniently, the poles are brought to one end of the set of wheels, a brass bar almost as long as the axle is placed upon that side of the axle which is uppermost when the plates are immersed, and, with the exception of the terminating wheels, passes through all the rest near their centres. One end of this bar is connected by copper straps to the positive plate, and the other to a copper strap, which, rising from the axle, passes through a slit in the front wheel; it is then bent down, and fastened by a small plate of brass, which is screwed firmly upon it. Another strap is soldered to the negative plate, passes through another slit, and is fastened in the same way, by a similar brass plate.* These brass plates, with the pincers for experiment, mounted, are represented at *a*, *a*. In fig. 7, the wheels are in the position which exhibits the plates out of the fluid. The pincers and brass plates are here shown, to avoid the necessity of another plate, although not in their proper places. It is evident that, when the plates are immersed in the fluid of the cistern, the dotted lines, *b*, *b*, mark the places which properly belong to them, and which must then be uppermost. When the operator has finished, and is about to turn the plates out of the fluid, he must first draw the pincers, &c. out of the brass plate. That this may be done almost instantaneously will be perceived by referring to fig. 8, which represents one of the brass plates with the pincer holder in its place; fig. 9, represents one of the pincers. It is hardly necessary to state, that the instrument which I have now described is sufficiently powerful to melt the metals, ignite charcoal intensely, &c. In fact, with one part of nitric acid to ninety of water, I found it impossible to fix platina wire, one tenth of an inch thick, and several inches long, in the pincers, as it melted instantly when in contact with the poles. In conformity with common observation relative to large plates, it produces neither shock nor decomposition. As in a certain position, the uniting wire situated east and west, a magnetic needle suspended below and near the wire is reversed, the north pole pointing directly to the south, its power in this respect is probably sufficiently great to accomplish all my purposes. I think it is not inferior, in relation to this power, to any of the instruments reported, and certainly superior in point of convenience either to the coil of Colonel Offerhaus,[*] or that of Mr. Pepys.[†] As it is necessary, however, to have instruments capable of producing the other galvanic effects, it occurred to me to form a battery of small plates upon the above plan. Fig. 10, represents one of this kind, with semicircular plates, eight inches in diameter, and arranged as in the large apparatus. This is four feet in length, and contains one hundred and forty-four plates, namely, forty-eight of zinc, and ninety-six of copper. Two of these placed parallel to each other, I have chosen to connect by an arc of thick brass wire at one end, and at the other by having plates of copper connected with the terminating plates inside, fixed to the outside of the wheels, as at *c*, with a sheath to each to receive the ends of the conductors, as in fig. 11. I am preparing another battery of this kind, with a much larger number of small plates. To facilitate the work of soldering connecting pieces to plates situated close to each other, suppose the third of an inch, one or more straps must be soldered to the edge of each plate, before they are fixed in their places, and then, by causing one strap to lap over the other, they can be easily united by the soldering tool.

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* These two straps are well varnished.

You will perceive, my dear Sir, that according to the arrangement of both these instruments, we possess the advantage to be derived from the simultaneous immersion of all the plates, an advantage which has been so ably illustrated by my friend Dr. Hare's calorimotor and deflagrator, and that by half a revolution of the wheels, which may be done in a few seconds by a slight effort, the plates are all in the air, and may be easily washed by a little water poured from a garden pot, or other convenient vessel. In this position they will remain unaffected until required for operation.

ELISHA DE BUTTS.

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[*] Edinburgh Journal, Vol. VIII.

[†] Brande's Journal, 1823.

TAXIDERMY;

OR,

THE ART OF PRESERVING OBJECTS IN NATURAL HISTORY.

(Concluded from page 7, Vol. III.)

Preservation of the Skins of Quadrupeds.[*]

HAVING skinned the animal, and removed the flesh from the bones of the legs and the head, (taking out the tongue and eyes,) the skin is to be dried, and smeared over with preservative. It is now ready for stuffing. A piece of wire is to be fixed in the skull, extending back to the tail, serving the purpose, and supplying the place, of the vertebral column, or spine. We are now to fill up with tow the places about the head where the flesh has been removed, and the artificial eyes are to be placed in the proper position. The projecting wire is then to be covered with tow, to nearly the original thickness of the neck of the animal, and the skin of the head and neck returned to its natural situation. Pieces of wire are to be fixed in each leg at the toes, passing them up under the skin, making them project beyond the bend of the thigh-bone and humerus, and there twisted round the vertebral wire. The vacuities are now to be filled up with tow to the original proportions of the body of the quadruped, and the specimen is to be fixed in a piece of wood, with the aid of the wires. It is then to be moulded, as it were, into a proper shape, and retained in it by means of tapes, &c.

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[*] Owing to an important error in our last, some repetition is here necessary. *Errata:* Page 7, line 31, *for* foramen magnunteral wire, *read* foramen magnum.

Birds.

In preserving birds, a great object should be to avoid, as much as possible, the soiling or ruffling of the feathers. Here we make our incision either under the wing or in the belly. In skinning, the body is not separated at the hip but at the knee joint. Having made bare the legs, we proceed, as in quadrupeds, separating the wings at the first joint, and the head at the atlas, removing the brains, eyes, and tongue, and freeing the rest of the bones of the wings and legs of their flesh. The skin is now to be dried and smeared with the preservative. In birds, only two wires are needed. One of them is to be introduced up the legs, and passed on to the head, where it is introduced into a hole bored in the skull. The other is introduced at the other leg, between the bone and the skin, but is merely twisted round the other wire. It will also be an advantage if the bones of the wings are connected by means of a piece of string. The vacuities are now to be filled up, the incision closed, and the specimen, as in quadrupeds, fixed on a board by means of the projecting wires. The feathers are to be dressed, washing away any blood by means of spirit of wine, and enabling them to resume their places by lifting them up with a pin. The proper shape and position is now to be given, aided by means of pins, tapes, bandages, &c. As the specimen dries, they may be gradually removed. Some of the smaller birds, indeed, may be stuffed without the aid of wires, the skin when dry being capable of retaining the position originally given.

We do not say that these directions will enable any one to mount birds to his own satisfaction. By perseverance, it is true, he may attain the art to some degree of perfection. He need not hope, however, to accomplish this until after he has spoiled many birds, and unless he is in the almost daily habit of stuffing. It therefore can scarcely be recommended to any one to attempt it, unless he intends to persevere.

The most common faults of a bad stuffed bird are the feathers being rough—the thickness of the body and neck being disproportionate—the neck being too thick or too thin, too long or too short, for the body. It is also a common fault that the body is too forward, the thighs being behind the rump. This, indeed, always happens to those who mount a bird for the first time, even although they have received proper instructions.

Fish.

As for fish, various methods have been practised for their preservation.

The simplest method consists in dividing the fish longitudinally and vertically, taking care to preserve, attached to the side we mean to preserve, the anal, dorsal, and caudal fins. From this side we scrape the flesh, and the skin is then stretched on a board and dried. It may then be spread on a piece of paper, and kept in portfolio.

Sometimes we extract the contents of the body at the mouth, or skin the fish, and then fill it up to the natural size by means of cotton or fine sand. We are unable, however, to retain the many brilliant colours and the original lustre which animals of this class possess when alive.

Some preserve their fish in spirits of wine, all their characters, except those depending on colour, being in this manner satisfactorily exhibited.

Insects.

They may be captured with the hand, with forceps, or with a gauze net, according to the species. Care ought to be taken to preserve the different parts, such as the limbs and antennæ, entire. They are then to be transfixed with a pin through the thorax, and fixed in a box having the bottom lined with cork. In the case of butterflies, however, it is proper to kill them by passing a pin through their sides laterally; since, otherwise, they would greatly injure their beauty by rubbing off the fine coloured scales with which they are covered. In many of the beetle kind, the killing of the animal is more difficult. Some impall them, and allow them to writhe in the pin till they die of pain and hunger. Others shorten their sufferings by exposing them to the fumes of sulphur; by passing through them a red-hot needle, or one dipt in aquafortis, or by putting oil of turpentine or tobacco into their mouths. Of these, fumigation is the most expeditious. We may also kill them by putting them in a tin box, which is to be half immersed in boiling water.

When the animal is dead, it is to be placed in a proper position till dry, when it is to be added to the collection. The collection itself may be kept either in drawers of hardwood, or in cases with a moveable glass cover. The bottom of each drawer is to be lined with cork, or wax, for the reception of the pins. It is then to be washed over with corrosive sublimate or arsenic, and white paper glued over it. The insects are to be distributed in rows, with their names marked below. The collection must be frequently inspected, to see if any insect depredators have got admission. These must be carefully removed, and their eggs destroyed by baking the suspected specimens in the sun, or before the fire.

Preserving in Spirits.

We will conclude this account of the different methods for preserving animals, with mentioning that entire animals, and the parts of others, may be kept in spirit of wine. When the object is large, it may be proper, previous to immersing, to inject a quantity of the spirits into the interior, to prevent incipient putrefaction, and consequent discoloration of the spirits. The great inconvenience that attends this method is the evaporation of the alcohol, and the risk of having the specimen destroyed by putrefaction. The mouth of the vessel ought therefore to be covered with two or three folds of bladder bound tightly round the edges with pack-thread. These layers ought to be well-coated with mucilage of gum arabic, glue, or the white of egg. Lastly, the surface of the outer layer is to be covered with coloured varnish, to improve the appearance of the preparation. The advantage attending a covering of glue, or mucilage, is that unlike the varnishes; it is insoluble in alcohol.

Botanical Subjects.

A collection of dried plants is called a herbarium, or hortus siccus. The plants are prepared by placing them, separated by folds of blossom paper, between two boards, changing the sheets as often as they become moist, and placing the whole near the fire, or in some warm situation. The plants must be gathered at that period of the year when they are in flower, and possess all their peculiar characters. When they are dried, they are to be laid on a sheet of white paper. As plants also are liable to insect foes, they are to be washed with a strong solution of corrosive sublimate in spirit of wine. Many beautiful preparations of aquatic plants, such as the algæ, may be made by spreading them out under water, on fine paper, laid over a plate of glass. They are then gradually to be raised out of the water, and dried.

Minerals.

As for minerals, little need be said. Than a well arranged and well kept collection of this kind, few spectacles can be more interesting and beautiful. To have frequent access to such, is absolutely necessary to any one who aims at an acquaintance with the species in mineralogy. It is to be regretted that there is no cabinet of this kind in Glasgow, with the exception of the Hunterian Museum, where the specimens are but few in number, are not properly arranged, and have no names attached.

Collections of minerals for sale, are kept by Mr. Mawes, No. 149, Strand, and Mr. Hewland, London. There are also several persons in Edinburgh who usually have a few on sale.

I may lastly mention, that there is a considerable duty on natural productions imported into this country—the tax on birds set on wires being 50 per cent. on the value, and when they are merely skinned, and on minerals 20 per cent. This is perhaps one of the most absurd impositions that this or any other government ever continued; since, while it can yield but a mere trifle to the revenue, it must tend materially to retard the progress of science. It is also remarkable that ours is the only state in Europe where such a regulation exists.

X. X. X.

Glasgow, 16th Feb. 1825.

LITHOGRAPHY.

Lithography, or the art of taking impressions from drawings or writings made on stone, is quite a modern invention. It, unlike letterpress or copperplate printing, which are altogether mechanical processes, depends entirely upon chemical principles, and has therefore been called in Germany, chemical printing. The principles on which it is founded are, first, the quality which a compact granular limestone has of imbibing grease or moisture; and, secondly, the decided antipathy of grease and water for each other. A drawing is made on the stone, either with ink or with a crayon of a greasy composition; it is then washed over with water, which sinks into those portions of the stone which are untouched with the grease of the drawing. A cylindrical roller, charged with printing ink, is then passed all over the stone; and, while the drawing receives the ink, the rest of the stone is preserved from it by the water, on account of the greasy nature of the ink.

This useful art was invented by mere accident. Alois Senefelder, the son of a performer at the Theatre Royal, Munich, a student of jurisprudence in the University of Ingoldstadt, after the death of his father, took likewise to the stage; but, being unsuccessful in his pursuit of it, he afterwards became an author. Poverty was, indeed, in him, the mother of invention; for, being too poor to publish his works, he tried various plans, with copper-plates and compositions, as substitutes for letter-press, that he might thus become his own printer. In the course of his experiments, he found that a composition of soap, wax, and lamp black, formed an excellent ink for writing with on plates; as, when dry, it became firm and hard, and resisted aquafortis. He wanted facility, however, in writing backwards on the plates; and, that he might practise this, at less expense, he procured some pieces of Kilheim stone, as a cheap material, on which, after polishing their surfaces, he might practise. Having been desired by his mother to take a list of some linen about to be sent to be washed, and having no paper at hand, he wrote it out on a piece of stone with his composition. When he was afterwards about to efface his writing, it occurred to him that impressions might be obtained from it; and, after he had eaten away the stone, with an acid, for about the hundredth part of an inch, he found that he could easily take successive impressions. It appeared to him, that the new mode of printing was of very considerable importance; and he therefore, through great difficulties, persevered in improving it, and in attempting its application to practical purposes.

He soon found that it was not necessary to have the letters raised above the stone; but that the chemical properties which keep grease and water so effectually separate from each other, were quite sufficient for his purpose. He afterwards bestowed much labour and assiduity in constructing the proper press, and other apparatus, for printing. The first essays to print for publication, were some pieces of music executed in 1796; afterwards he attempted drawings and writings. He still, however, found great difficulty in writing backwards, and this led him to think of the process of transfer; and the use of dry soap, which was found to leave permanent traces which would give impressions, naturally led to the mode of chalk drawings.

In 1799, after having made many improvements, Mr. Senefelder obtained a patent privilege for Bavaria. He then made known his invention to Mr. André, of Offenbach, with whom he entered into partnership, and proposed to establish printing-offices, and take out patents at London, Paris, and Vienna. In order to establish presses in England, Senefelder came to London with a brother of Mr. André's; and most of the English artists made trial of the art. But, unfortunately, it was not then fully understood; and the difference of materials of Germany and those of England, used both for the purposes of drawing and printing, caused constant failures, and the artists in succession abandoned it.

An attempt was made, in 1800, by Senefelder alone, to establish presses in Vienna; and, after great difficulty, a patent was obtained: but bad management, and some unfortunate circumstances, prevented it succeeding, and he returned to

Munich in 1806, leaving the establishment which he had formed in other hands.

In 1806, Mr. Mitterer, Professor of Drawing in the public school at Munich, practised lithography to obtain copies for his pupils. He is said to have invented the chalk composition in its present form, or at least to have improved it greatly.

The practice of the art now began rapidly to extend and improve, more particularly at Munich, where several establishments were formed for the purpose of applying it to the fine arts, as well as for printing writings and official forms for the different departments of the Government. In 1809, Senefelder was appointed Inspector of the Royal Lithographic Establishment at Munich, for printing from stone a complete map and survey of Bavaria; since which period he has devoted his time to experiments, and to writing the history of his invention. In England it can hardly be said to have been entirely given up from the time of its first introduction in 1800, yet it was little practised or thought of after 1806, until it was revived in 1817. Since this it has been more generally attended to, and some of the establishments having now become well acquainted with the process of printing, specimens have been produced in England equal to those of any other country. In France but little was done in lithography till 1815, when it was established at Paris by Lasteyrie; and, being taken up by good artists, it soon attained great excellence. About the same time it extended to Russia and other parts of Europe.

(To be continued.)

ZOOLOGY.

Lincolnshire Sheep.

THE sheep of this county are almost peculiar to it. They are of a large size, have horns, and produce heavy fleeces of long wool, highly prized in the manufacture of stuffs, and some kind of baizes. The flesh is, however, rank in flavour; and, unless the animals are improved by crossing, is not generally relished. As the foundation of an excellent breed, they were selected by the late judicious Mr. Bakewell, who, from mixing them with other races, produced those excellent sheep known by the name of new Leicesters. The fleeces of the pure Lincolnshire sheep, in general, weigh from 10 to 12 lbs. but extraordinary instances have been known in which they have attained more than 20 lbs.

The Hyæna Venatica, or Wild African Dog.

This animal, which is remarkable for hunting in regular packs, is smaller and more slender than the common-shaped hyæna, or the spotted one, or *Crocuta*. The general colour is a sandy bay, or an ochraceous yellow, shaded with a darker brown. The whole body is blotched and brindled with black, with occasional spots of white, and the legs are generally marked in the same manner. These marks vary in different individuals, but the more constant ones are a deep black stripe, extending from the nose up to the middle of the face, and between the ears: these are blackish both within and without, and covered with short close hair, which is sometimes very thin: at the interior margin of the ears on the inside, there is a thin and observable tuft of whitish hair: the nose and muzzle are black. The tail is bushy like that of the fox, and is divided in the middle by a ring of black, above which, or towards the insertion, the colour is nearly the same as the general tint of the body; but below, or towards the tail, it is white.

The dog, the wolf, and the hyæna, correspond in having six grinders in the upper jaw, and in the lower seven. They also agree in the form and number of their ribs, and lumbar vertebræ, having seven of the latter. Their ribs, of which there are *thirteen*, are thin and narrow. But both in the striped and spotted hyæna they are *fifteen* in number, and of an extraordinary breadth; and are proportionally much stronger and larger than in any quadruped of their size: in these, the grinders are only four, or at most five, and the lumbar vertebræ not more than five.

The present animal, therefore, with respect to its teeth, ribs, and lumbar vertebræ, would be arranged in the genus *Canis*, from which it differs, however, in having only four toes on each foot, and it is said in other essential particulars. With the genus Hyæna it agrees in number of toes, but differs from it in bulk, and in the conformation of the skeleton. These differences were first noticed by Mr. Brookes, who considers it as forming a new genus.

Mr. Burchell, from whose *Travels in Africa*, vol. ii. p. 229, the above account is taken, informs us that he had one of these animals in his possession for thirteen months chained in a stable-yard, and that, during that time, its ferocious nature deterred every person from attempting to tame it; but it became at length so much softened in manners as to play with a common domestic dog. The man, however, who fed it, never durst venture his hand upon it.

Annual return of Migrating Birds to the same spot.

The late Dr. Jenner, in a curious paper on the migration of birds, published since his death in the Philosophical Transactions for 1824, mentions the following curious experiment: "At a farm-house in this neighbourhood, I procured several swifts, and by taking off two claws from the foot of twelve, I fixed upon them an indelible mark. The year following, their nesting places were examined in an evening, when they had retired to roost, and there I found several of the marked birds. The second and third year a similar search was made, and did not fail to produce some of those that were marked. I now ceased to make an annual search; but, at the expiration of seven years, a cat was seen to bring a bird into the farmer's kitchen, and this also proved to be one of those marked for the experiment.

LAMPS FOR LIGHT-HOUSES.

ARGAND LAMPS, having hollow cylindrical wicks placed before reflecting mirrors, are now generally used for light-houses. A number of lamps are fixed together on a frame, and protected from the weather by glass windows. They are generally fed with oil, but in a very few places with pit coal gas.

In many of the light-houses on the British coast, the frame in which the lamps are fixed is made to revolve by means of clock-work, so that to a spectator, situated in the circle of which the light-house is the centre, the light appears at its brightest at the end of a stated period of time, which is generally one or two minutes. The revolving of the light enables the seamen to distinguish the light-house from the light of lime-kilns or other fires upon the coast. This distinction is of great importance, for shipwrecks have often happened in consequence of their taking the light of lime-kilns for the light of the light-house not far distant. The light is, in some light-houses, made of a red tinge to distinguish it from some other light-house not far distant. The red colour of the light is produced by placing windows of red glass before the lamps. Red is the only colour that can be given to the light in this way. When stained glass of other colours is placed before the lamp, it is not found to produce a change in the colour of light seen at any distance; the blue or green colour of the glass becomes insensible when seen through a great body of air, which has itself a blue colour.

ON SAFETY VALVES.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—Amongst practical men of my acquaintance, I have often witnessed warm debates relative to the quantity of water necessary to condense a given quantity of steam; or, in other words, the quantity of injection water necessary for a steam engine of given dimensions. The insertion of the following explanation and formula, for their information, will much oblige,

Gentlemen, yours, &c.
B. R. D. R.

Glasgow, 15th Feb. 1825.

The safety valves of almost all boilers, in this part of the country, are loaded with 3 lbs. or $3\frac{1}{2}$ lbs. for each square inch of their area. Taking $3\frac{1}{2}$ lbs. in the present enquiry, the temperature of steam necessary to balance this pressure, according to the best experiments, is that of 223° of Fahrenheit; but, besides this, there is 940° not indicated by the thermometer, which makes the real temperature equal to 1163°: now, 1 cubic foot of steam, at this temperature, when condensed, measures 1 cubic foot of water—calling the temperature of the cold water 50° and that of the warm water 100°. We must deduct 100°, the heat of the water formed by condensation, from 1163, which leaves 1063 to be communicated to the injection water; and, since each cubic inch of this water requires 50° of heat to make it of the same temperature with the hot; well, $\frac{1063}{50}$, or 21.06, exhibits the number of cubic inches of water necessary to condense one cubic foot of steam. From this is derived the following formula:

Let $h =$ the sensible and latent heat of the steam; $a =$ the temperature of the cold water; $b =$ the temperature of the warm water; $x =$ the cubic inches of water necessary to condense; q, the quantity of steam to be condensed. Then $q \times h - b = x \times b - a$: therefore, $x = q \times \frac{h - b}{b - a}$.

To illustrate this, let 1160 denote the sensible and latent heat of the steam; 60 the temperature of the cold water; 100 the temperature of the warm water; and 7 cubic feet the quantity of steam to be condensed. Then $7 \times \frac{1160 - 100}{100 - 60} = 185.5$ cubic inches of water necessary to condense 7 cubic feet of steam of the temperature 220°.

STEAM ENGINE QUERY IN No. LVI. Vol. II. ANSWERED.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen, — In No. LVI. Vol. II. is a query by B. R. D. R. whether there is any difference between the power of a steam engine, with a short stroke, and one with a long stroke, the piston moving through equal spaces in the same time, and other circumstances being the same. There is certainly a considerable difference in favour of the long stroke, which will be obvious when it is considered that a ponderous mass, in rapid motion, has a great momentum; and that a force, equal to the momentum of matter in motion, is required to stop it, and also to put it in motion; for, according to the law of motion, action and re-action are reciprocal and equal. All the moving parts of a reciprocating steam engine are alternately forced from rest to motion, and from motion to rest, at the expense of the power of the steam; but the longer the stroke, the fewer are the changes—consequently the loss of power from this cause is in inverse ratio to the length of the cylinder. An engine with a stroke six feet, will therefore spend only half the power, on its own action, which one with a stroke three feet requires, if equal in other respects. To those acquainted with mechanics, it is needless to observe that a fly-wheel does not prevent the loss of power above considered, nor even diminish it; but, on the contrary, increases the loss by all that which would be required to drive the fly, supposing it detached from the engine. The use of the fly-wheel, as is well known, is to equalise, not increase, the power.

The loss of power from the above cause is the principal defect of the steam engine, as it is at present; and, to get rid of it, is the advantage proposed by a primary rotatory motion. It appears that this improvement was early attempted by Mr. Watt, and also by many others; but in which none has yet succeeded, on account of the loss of steam and increase of friction overbalancing the said defect. However, when these difficulties are overcome, and steam is made to act on a rotator with the same advantage as on a piston and cylinder, there is little doubt that the rotatory steam engine will excel the reciprocating one as far as the latter does that of Newcomen.

I am, Gentlemen, yours, &c.

G. M.

Glasgow, 9th Feb. 1825.

ON THUNDER RODS.

To the Editor of the
Glasgow Mechanics' Magazine.

Gentlemen, — In No. LIV. Vol. II. of your Magazine, there is a letter on the Jail Conductor, or Thunder Rod, dated as far back as the 20th October, 1824, accompanied with a preface by yourselves, wherein the author, Mr. John Herbertson, Junior, says, that I had personal views in publishing strictures on the various Thunder Rods in Glasgow, and that the promotion of science was but a secondary motive with me.

As I do not wish to take up the pages of your Magazine with useless or irrelevant matter, I shall content myself, in the mean time, by shortly saying to Mr. Herbertson, that he might as well have supposed that I was actuated by pride, conceit, or the vanity of showing off my electrical acquirements, as that I was actuated by personality. The criticism on the Jail Thunder Rod is just, and not more severe than such bungling deserves; and I am of opinion that Mr. Herbertson's time would have been better employed in endeavouring to correct the imperfections of the Jail Conductor, than in contriving to bandy the construction of this unscientific rod from the shoulders of one person to those of another.

I am, Gentlemen, yours, &c.

J. P.

Glasgow, 10th January, 1825.

ON THE BEARINGS OF THE BELL ROCK LIGHT-HOUSE.

Gentlemen, — In that excellent article, "The Bell Rock Light-house," No. LV. the *bearings* and *distances* are most *inaccurately* laid down, and should be corrected. You have, for instance, stated it to be nearer the Redhead than Arbroath, and southerly (as it is) from both. You are not aware that the Redhead is four miles north from Arbroath, and of course must be so much farther off, than being nearer to the Bell Rock than that town. But this is not all.—Take the corrections as under.

In your account the Bell Rock is situated 11 m. S. W. from the Redhead,......	In fact it is...... 16 m. S. by E.
12 m. S. from Arbroath,...............	.... 12 m. S. E.
17 m. N. E. from the Isle of May,	.... 17 m. N. by E.
30 m. N. E. from St. Abb's-head,...	.... 38 m. N. by W.

The Longitude and Latitude is right enough.

E. N. Irvine.

☞ See Thomson's Maps of Scotland in the Atlas (large), published about ten years ago.

TABLES OF THE VARIOUS SPECIES OF PERIODICAL BIRDS OBSERVED IN THE NEIGHBOURHOOD OF MANCHESTER.

By Mr. John Blackwall.

Table I.—*Periodical Summer Birds.*

		Appear.	Disappear.
Sand Martin	Hirundo riparia	April 6	Sept. 16
Wryneck	Yunx torquillo	April 6	
Water Wren	Motacilla trochilus	April 12	Sept. 12
Redstart	Motacilla phoenicurus	April 13	Sept. 5
Wheatear	Motacilla oenanthe	April 14	Sept. 13
Swallow	Hirundo rustica	April 18	Oct. 11
Winchat	Motacilla rubetra	April 20	Sept. 17
Black-cap	Motacilla atricapilla	April 22	Sept. 17
Martin	Hirundo urbica	April 23	Oct. 13
Cuckoo	Cuculos canorus	April 24	June 28
Yellow Willow Wren	Motacilla sylvicolo	April 28	Sept. 10
Stonechat	Motacilla rubicola	April 28	Sept. 10
Sandpiper	Tringa hypoleucos	April 29	Sept. 19
Grasshopper Warbler	Motacilla locustella	April 30	
Whitethroat	Motacilla sylvia	May 2	Sept. 17
Swift	Hirundo apus	May 8	Aug. 18
Pettychaps	Motacilla hortensis	May 12	Sept. 11
Land Rail	Rallus crex	May 14	Sept. 30
Fly-catcher	Muscicapa grisola	May 14	Sept. 13
Hedge Warbler	Motacilla salicaria	May 19	
Red-backed Shrike	Lanius collurio	May 19	
Goat-sucker	Caprimulgus Europeus		Sept. 13

Table II.—*Periodical Winter Birds.*

		Appear.	Disappear.
Snipe	Scollopax gallinago	Sept. 28	March 31
Redwing	Turdus Iliacus	Oct. 9	March 26
Mountain Finch	Fringilla montifringilla	Oct. 18	April 14
Woodcock	Scolopax rusticola	Oct. 26	April 2
Jack Snipe	Scolopax gallinula	Oct. 26	
Fieldfare	Turdus pilaris	Nov. 1	March 18
Water Rail	Rallus aquaticus		

Table III.—*Birds irregular in Appearing and Disappearing.*

		Appear.	Disappear.
Crossbill	Loxia curvirostra	Aug. 5	Nov. 19
Siskin	Fringilla spinus	Dec.	
Chatterer	Ampelis garrulus		
Hoopoe	Upupa epops		
Great Shrike	Lanius exubitor		

TABLE IV.—*Birds partially Periodical.*

		Appear.	Disappear.
Throstle	Turdus musicus	Feb. 4	Nov. 2
Starling	Sturnus vulgaris	Feb. 9	Aug.
Green Grosbeak	Loxia chloris	Feb. 25	Oct. 23
Common Bunting	Emberiza miliaria	March 3	
Pied Wagtail	Motacilla alba	March 11	Oct. 16
Red Bunting	Emberiza schoeniclus	March 17	Sept.
Lesser Redpole	Fringilla linaria	April 3	Nov. 5
Yellow Wagtail	Motacilla flava	April 17	Sept. 10
Lapwing	Tringa vanellus	April	
Merlin	Falco æsalon	Oct.	
Grey Wagtail	Motacilla boarula		April
Ring Ouzel	Turdus torquatus	Dec.	

TABLE V.—*Catalogue of Singing Birds, with the time of their beginning and ceasing to sing, from a mean of five years' observation, with the numerical value of their notes, twenty being that of absolute perfection.*

	Begins.	Ends.	Mellowness.	Sprightliness.	Plaintiveness.	Compass.	Execution.
Redbreast,..........	Jan. 3	Dec. 14	9	8	12	14	14
Wren, ...	Jan. 13	Dec. 3	1	16	0	4	5
Missel Thrush, ...	Feb. 1	May 28	3	4	1	5	3
Throstle, ...	Feb. 8	Aug. 12	3	10	2	10	4
Skylark, ...	Feb. 9	July 8	4	19	4	18	18
Hedge Warbler,...	Feb. 9	July 19	3	4	3	4	4
Chaffinch,..........	Feb. 10	July 7	2	14	1	4	5
Starling,............	Feb. 15	May 30	4	2	2	4	2
Blackbird, ...	March 20	July 13	8	1	4	5	3
Green Grosbeak,..	March 24	Aug. 12	5	3	5	5	5
Titlark, ...	April 4	July 9	3	2	2	2	2
Lesser Redpole,...	April 5	Aug. 5	1	4	0	3	3
Woodlark,..........	April	Oct. 25	18	2	17	8	6
Goldfinch,..........	April 11	June	4	16	4	10	12
Redstart,...........	April 14	June 29	1	4	0	2	2
Willow Wren, ...	April 14	Aug. 23	6	4	5	5	5
Linnet,.............	April 15	July 6	10	15	6	12	13
Lesser Field-Lark,	April 17	July 8	8	7	5	4	5
Swallow, ...	April 19	Sept. 25	4	6	2	3	3
Stonechat, ...	April 24	June	1	3	0	3	2
Whinchat, ...	April 25	July 1	1	3	0	2	2
Black-cap,..........	April 25	July 22	14	12	12	10	8
Whitethroat, ...	April 29	July 16	1	4	0	3	3
Pettychaps,.........	May 12	July 11	14	6	14	10	9
Sedge Warbler,....	May 17	July 16	2	16	0	18	14

EFFECT OF CHANGES OF TEMPERATURE ON THE IMPELLING POWER OF MOVING WATER.

To the Editor of the
American Journal of Science and Arts.

SIR,—A singular circumstance has been observed in this vicinity lately, which has given rise to considerable discussion. The opinions entertained respecting it by those who have turned their attention to it, are various; nor has any one been able to account, satisfactorily, for it. This induces me to trouble you with a brief narration of it, believing that every fact of the kind will be, by you, deemed worthy to be added to that stock of knowledge, which observation has been gleaning and treasuring up for the scrutiny of science.

At the mouth of a creek which empties itself into the Susquehannah, a short distance south of the Columbia bridge, there stands a saw-mill, which cuts an immense quantity of timber. The owners, as well as several of the workmen who attend the mill, state it as a fact that at *night*, in the course of a given time, with the same head or quantity of water, and without any alteration being made in the gearing, or machinery of the mill, the saw cuts much more timber, than it does in the same time in *day-light;* and further, that it cuts more in a given time in *winter* than it does in *summer*. The owners, from being accustomed to the motion and tone of the saw in the course of the day, say they can readily perceive an increase of strokes and a greater force in the saw, at night; but how to account for it they know not. It has become a matter of much speculation and dispute among the mechanics, workmen, and floaters of lumber on the Susquehannah.—A gentleman, who deals largely in lumber, and who sometimes attends to the floating of rafts himself, states, that a raft will float nearly a third faster in the *night*, than in the *day*. The two facts are probably referable to the same cause; and the discovery of that cause is desirable.

SAMUEL WAGNER.

REMARK.

No other explanation of the facts stated above occurs than that which is implied in the title given to this fragment. It would be interesting to know, whether other persons have noticed the same facts, and whether the mills have been observed to move more slowly as the water approaches the freezing point, which ought to be the fact, as between 40° and 32° water grows lighter, although growing colder, according to a remarkable, but now well established exception in the case of this fluid.—*Ed. Am. Journ.*

QUERIES, &c.

Washerwomen say that the temper of the wearer has a great effect upon the shirt in cleansing. Is there any truth in the assertion?—V.

Observe the new moon through a silk napkin, and the number of moons visible will denote her age in days. This holds good till she is five or six days old. What is the cause of this phenomenon?—V.

MISCELLANIES.

Remarkable height of the Barometer.—The Barometer at Worcester lately stood at the extraordinary height of 30 inches 96-100ths, a point of elevation exceeding by 6-100ths, any observation made in that neighbourhood, for many years past. This fact is the more remarkable, as there was not that dryness in the air which usually accompanies this state of the mercury.

Hatching of Fish.—The Chinese have a method of hatching the spawn of fish, and thus protecting it from those accidents which ordinarily destroy so large a portion of it. The fishermen collect with care, on the margin and surface of waters, all those gelatinous masses which contain the spawn of fish; after they have found a sufficient quantity, they fill with it the shell of a fresh hen's egg, which they have previously emptied, stop up the hole, and put it under a setting fowl. At the expiration of a certain number of days, they break the shell in water warmed by the sun: the young fry are presently hatched, and are kept in pure fresh water till they are large enough to be thrown into the pond with the old fish. The sale of spawn for this purpose, forms an important branch of trade in China.

NOTICES TO CORRESPONDENTS.

A Queryist is mistaken in his supposition.—Mr. Saul will find his postscript attended to more punctually in future.—Communications received from F. B.. and Mr. Dixon Valance.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

"The same truth which is a Principle in Science, becomes a Rule in Art."

No. LXI. *Saturday, 26th February,* 1825. Price 3*d.*

ACCORDS IN NATURE.—NEW SELF-ACTING LEVER SLUICE, &c.

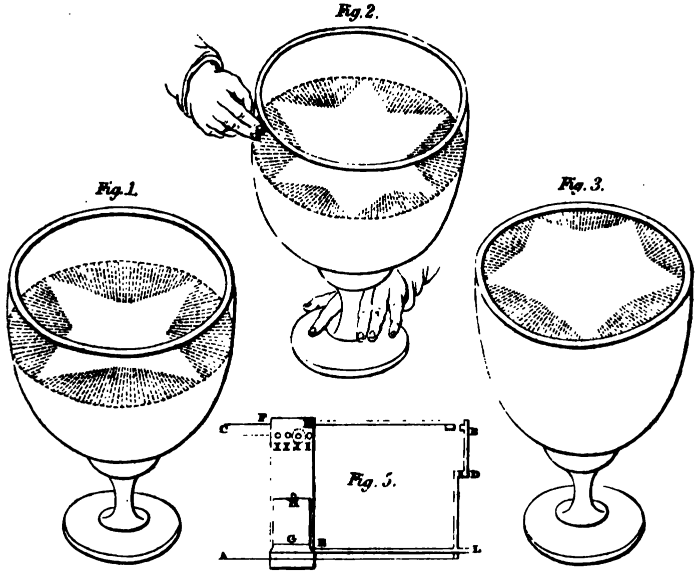


Fig. 4.

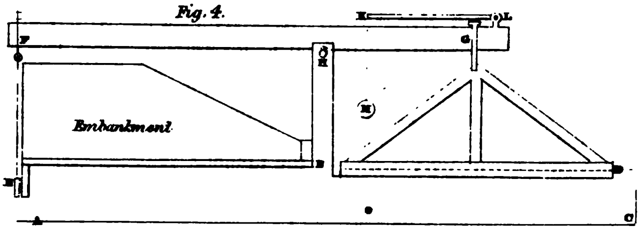
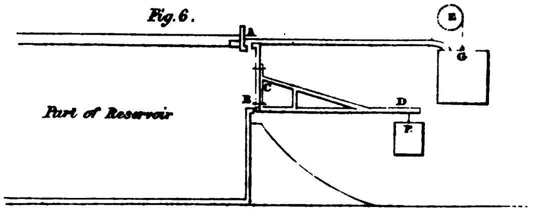


Fig. 6.



— Swan Sc. —

ACCORDS IN NATURE.

THE following curious fact we copy from 'The Chemist,' No. 45, for 15th January last. We have often observed it ourselves. If the water is warm, and a spoonful of rum be placed gently on the water, so as to swim on the top, the appearance will be more distinct, and an extraordinary ebullition will appear in the centre of the tumbler.

"Take a large goblet (the larger the better), and having filled it two-thirds with water, produce a tone from it, by rubbing the hand previously wetted (or a rosined bow) on the outside of the rim, in the manner the musical glasses are played; with this difference, that you confine the friction as much as possible to *one* point until the tone is produced. *Four* points only of the circle of the glass will become agitated, and these of *equal distances* from each other; which points may be distinctly seen by observing the rimpling they make on the surface of the water, as in fig. 1. If the tone or note be now raised to a fifth from the first, which may easily be done after a little practice, *six* points in the sides of the glass will become agitated, indicating that six portions of the circle are in motion: see fig. 2. If now you raise the tone to the octave, *eight* points of agitation will be distinctly seen. When the vibrations combine in odd numbers, they give five radii, as in fig. 3.

A large bell-glass, supported steadily on a foot, is more easily made to produce these different tones by the wet hand than a common goblet, and the rimpling on the surface of the water will be more defined and distinct.

These little experiments show a certain accordance in very different things; or rather we should say, in different parts of the kingdom of nature. It is somewhat remarkable, that the tones which are 'to the ear harmony,' should also cause those definite and regular forms which are beauty to the eye."

DESCRIPTION OF A NEW SELF-ACTING LEVER SLUICE, AND OF A WASTER SLUICE.

Invented by ROBERT THOM, Esq. Rothsay.

The Lever Sluice, Figure 4.

THIS apparatus, when placed on a reservoir that supplies any canal, mill, or other work with water, (where the aqueduct between the reservoir and such work is on a level,) will always open of its own accord, and let down the quantity of water wanted by such work and no more; so that it not only supersedes a waterman, but also saves a great deal of water.

Fig. 4, A, B, is a tunnel through which the water passes from the reservoir to

B, C, the aqueduct that carries the water to the mills.

B, D, a float that rises and falls with the water in the aqueduct.

A, an aperture in the mouth of the tunnel.

E, the self-acting sluice that opens and shuts that aperture.

F, G, a lever which turns upon the fulcrum H, and is connected at one end with sluice E, and at the other with the float B, D.

The sluice E, is here represented open, (as when the mills are going,) but when the water is stopped at the mills, it rises in the aqueduct, and with it the float B, D, which raises the end G, and lowers the end, F, of the lever F, G, and shuts the sluice E. When the water is again let upon the wheel at the mills, the surface of the aqueduct falls, and with it the float, which opens the sluice E, as before.

Upon the lever F, G, there is another small lever K, L, which turns upon the fulcrum L, and has a weight M, suspended to the other end K. In the ordinary working of the apparatus this lever is quite stationary, and produces no effect whatever; but during floods, the aqueduct is swelled by streams that run into it between the reservoir and the mills, and when this happens when the mills are not at work, the water, rising in the aqueduct, presses up the float upon one end of the lever when the other can get no farther down, and would thereby strain or break the apparatus; but by this contrivance this extra pressure merely pushes up the small lever K, L, without straining any other part. Of course, the weight M, is so adjusted, that the lever K, L, will not at any time move till the sluice is shut, but upon the least extra pressure after it shuts, the lever will rise.

The dimensions of the float are nineteen feet square by seven inches deep; the lever is twenty-seven feet long, being twice the length between the fulcrum and the sluice that it is between the fulcrum and the float. The sluice is three feet three inches long, and fifteen inches deep.

To determine the proper dimensions of the float, and relative lengths of the ends of the lever, it was necessary to ascertain how far the sluice required to be raised to pass the quantity of water wanted, and also how far the water in the aqueduct might be raised above the level absolutely necessary for supplying the works; the first was found to be seven inches, and the last only four inches. The end of the lever connected with the float was made therefore only half the length of the end connected with the sluice; and the float was made of such dimensions, that when sunk half an inch in water, the weight of water thereby displaced was equal to twice the weight required to shut the sluice.* When, therefore, the water in the aqueduct rises upon the float half an inch, (besides what it sinks by its own weight,) the sluice begins to move; and by the time the water rises other three inches and a half, the sluice is of course seven inches down, or shut.

This apparatus was erected at Rothsay in 1816.

The Waster Sluice, Figure 5.

This sluice, when placed upon any river, canal, reservoir, or collection of water, prevents the water within the embankment from rising above the height we choose to assign to it; for whenever it rises to that height the sluice opens and passes the extra water; and, whenever that extra water is passed, it shuts again; so that whilst it saves the banks at all times from damage by overflow, it never wastes any water we wish to retain.

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* Twice the weight, because here the lever is two to one against the float. To ascertain the power required to open or shut the sluice, (which is easily done by a lever and weights,) it must be tried when the water in the reservoir is at the highest, which, in this case, is seven feet above the bottom of the sluice. To ascertain how far the sluice must be raised to pass the necessary supply, it must be tried when the water in the reservoir is nearly at the lowest, and in this instance was done when it stood three feet above the bottom of the sluice. The quantity of water required is equal to about the power of fifty horses, the fall at the wheel being twenty feet. The aqueduct is about seven hundred yards long, twelve feet wide, three deep, and its bottom about twelve inches lower than the bottomof the sluice.

A, C, B, L, is part of a canal, river, stream, or collection of water.

B, C, high-water-mark, or the greatest height to which the water is to be allowed to rise.

B, D, a sluice, or folding dam, which turns on pivots at D.

E, F, a hollow cylinder, having a small aperture in its bottom, to which is joined

E, L, a small pipe always open.

I, I, I, I, small holes in the cylinder E, F, on the line of high-water-mark.

G, H, another cylinder, water-proof, that moves up and down freely within the cylinder E, F; and the weight of which keeps the sluice B, D, shut by its connection with

B, K, H, a chain fixed to the cylinder G, H, at H, thence passing over the pulley K, has its other end fixed to the sluice B, D, at B.

When the water in the canal, river, or pond, rises to the line B, C, it passes into the cylinder E, F, at the small holes I, I, I, I; and this lessens the weight of cylinder G, H, so much, that the pressure of the water in front of sluice B, D, throws it open. When the water subsides, so as not to enter these holes, the cylinder is emptied by the tube E, L, and then the weight of the cylinder G, H, shuts the sluice as before. The dimensions and weight of this cylinder must of course correspond with the weight of the column of water pressing upon the sluice B, D. An apparatus of this kind was first erected at Rothsay in 1817. The dimensions of one of these are:—cylinder G, H, two feet diameter, and two feet deep over all; weight 500 lbs.[*] Cylinder E, F, five feet ten inches deep, two feet one inch diameter inside: sluice B, D, four feet long and two feet deep.

This sluice is here represented with the pivots on which it turns at its under edge, but they may be placed either at the upper or under edge, as circumstances render advisable. The upper edge is also here represented on a level with high-water-mark, but, if necessary, it may be placed any where between that and the bottom of the pond or aqueduct, or right below, as on an aqueduct bridge, or similar situation. The cylinders may also be placed on the outside of the dam or embankment, by having a pipe to communicate between them and the water within; but in whatever situation the sluice or cylinders may be placed, the pipe that communicates between the cylinders and the water within the embankment must always have its opening there exactly at the level of high-water-mark, or at the greatest height to which the water therein is to be permitted to rise.

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[*] This weight is considerably more than necessary when the sluice is placed with the pivots at its under, and the chain at its upper, edge; but it was calculated to be powerful enough when the sluice was turned with the pivots at its upper and the chain at its under edge, to which position it has since been changed.

Although the cylinder G, H, requires to be heavier to shut the sluice when its pivots are at the top, yet, to pass the same quantity of water, it does not require to move half so far as when they are at the bottom, and therefore the cylinder E, F, may be made much shorter; so that the cost in either case is nearly the same, or rather in favour of the pivots being at the top. In most cases this last position is preferable; there are instances, however, in which the other is more advisable, such as in a river where wood, ice, or other bulky substances may be expected to float occasionally on the surface; but such cases require a particular construction adapted to the circumstances.

On this principle, a self-acting dam may be raised in any river or stream, up to high-water-mark, by which means a considerable reservoir will be obtained, whilst, during floods, the dam will fold down, and no new ground be overflowed.

In lawns or pleasure grounds, through which streams or rivulets flow, these sluices might be applied to advantage; for, by placing one on the bank of each pond, the water within would always be kept at the same height, whether the weather were wet or dry; and hence flowers or shrubs might be planted close to the water's edge, or in it, (as best suits their respective habits,) and their position with regard to water would always be the same.

Figure 6.

This is merely a different construction of the waster sluice fig. 5.

A, B, is the sluice which turns on pivots at the upper edge A.

C, D, a lever attached to that sluice.

E, a hollow can of cast iron, attached to the extremity of that lever at D, and into which small stones are put until it becomes heavy enough to shut the sluice against the pressure of the water in front.

F, a pulley.

G, a hollow cylinder of copper (or tin-plate painted,) with a small aperture in its bottom.

D, F, G, a chain, one end of which is fixed to the lever at D, then, passing over the pulley F, has its other end fixed to the cylinder G.

A, H, a tube which communicates between the water in front of the sluice A, B, and cylinder G.

When, therefore, the water in front of the sluice is not so high as to flow along the tube A, H, the sluice A, B, remains shut; but when the water rises so as to flow along that tube, it fills the cylinder G which then descending, raises the lever C, D, and can E, and opens the sluice. Again, when the water falls so as not to flow along the tube A, H, the cylinder G is emptied by the small aperture in its bottom, and then the can E shuts the sluice. I erected a sluice of this construction in 1821, at Cartsburn-mill, Greenock. The sluice is four feet long, two and a half feet deep; the lever five feet long from B to D, the cylinder E, sixteen inches diameter, and eighteen inches deep, and filled with small stones till it weighs two hundred and sixty pounds.* The cylinder G, is eighteen inches deep, and the same diameter. This method, wherever it can be adopted, is preferable to that of fig. 5; being simpler and less expensive in the construction.

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* The quantity of water pressing upon the sluice is twelve and a half cubic feet, or 781 lbs. The pressure at the upper edge of the sluice is to that at its under edge as 8 to 22 nearly; therefore the pivots of the sluice support 208 lbs., which leaves 573 to be supported by the can E; but there is a lever power of two to one, which reduces this weight one half, or to 286 lbs. The weight of the lever C, D, itself, is equal to about 30 lbs. more than the weight of the empty cylinder G; so that the whole weight of the can E, requires only to be 260 lbs.

ESSAYS ON WEAVING.

I.—GENERAL HISTORY OF THE ART.

THE atmosphere is so variable, both as to temperature and humidity, that few animals, if unprovided with some defence, and if exposed naked to its vicissitudes, would be long able to survive its effects. Nature has accordingly furnished them with some sort of covering; enveloping the quadruped in a thick fur, and the bird in a warm coating of feathers. Man, however, she has left to his own resources, having endowed him with powers capable of appreciating and providing for his own wants. Accordingly, he is so exposed to the changes in the atmosphere, that the necessity of possessing some artificial covering for his protection, would be among the first discoveries that he would make. Hence there is not a tribe, however rude and uncultivated, but what employs some sort of dress. Among the most barbarous, the skins of the animals which they have slain in the chase are employed for this purpose. It is not, however, until they make a nearer approach to civilization, that we can detect the first rude and imperfect attempts at the art of weaving; like the natives of the south sea islands, interlacing the fibrous portion of the bark of trees or of vegetables, displaying, even in their rude productions, the marks of patient industry, and of no common degree of ingenuity.

The Egyptians are universally regarded as the first people that made any progress in the arts of civilized life. Accordingly we find them noticed as being celebrated for the manufacture of fine linen. It was from them that the Jews derived it during their long period of bondage; it being mentioned in Scripture that they soon after made use of it in preparing the ornaments for the tabernacle. The art was also borrowed by the Greeks, as well as other neighbouring nations, who, if we trust the descriptions of their more ancient poets, succeeded in carrying it to a considerable degree of perfection. The Romans, again, were indebted to the Greeks, deriving almost the whole of their acquaintance with the arts and sciences from this source; whilst they spread the knowledge of this, as well as the other useful arts, wherever they carried their victorious arms.

As the productions of the art, in these early periods of its history, were rude, so also were its implements and manipulation. It is probable that they carried it on in the same manner as is at present practised by the natives of India, and till within very lately in our own country. The thread was spun by means of the spindle and distaff, and the cloth woven by a slow and simple process. Yet, although the art was rude, still it was honourable, the weaving of cloth being the only occupation in which the daughters of kings and princes deigned to occupy themselves.

In this state it continued for many centuries, without undergoing any material improvement. As to our own country, it was introduced by the Romans—our ancestors, previous to their arrival, being partially covered with the skins of animals, and the parts exposed painted red, of various figures. They soon after established a woollen manufactory at Winchester, for clothing their army, and instructed the natives in the culture of flax, and in weaving. Little farther is known of the art till the reign of Edward III. who is distinguished as the first monarch in this island, who directed his attention to the promotion of the arts and manufactures. The particular branch that he encouraged was the woollen manufacture; introducing for this purpose, in the year 1331, a number of weavers and cloth-workers from the continent. They were followed by two Brabant linen weavers, who also received the patronage of the king, and settled at York. They were followed by numbers of their countrymen; so that, in 1351, foreign weavers are described as being numerous in London. They afterwards, during 1557 and 1558, received an additional increase from the persecutions carried on against the Protestants in France, and by the Duke of Alva in the Netherlands. They were the means of introducing into this country the manufacture of crape, baize, serge, and other stuffs; thus adding to the future wealth and resources of the country which had yielded them protection.

About this time also, silk weaving became common in this country. It was first practised in the East, and afterwards introduced among the Greeks towards the decline of the Roman empire. From thence it was brought into Italy by the Venetians, and afterwards passed into England, being carried on by women, in the year 1455.

In 1685, nearly seventy thousand operative manufacturers of various descriptions came to England for refuge, being driven from France by the revocation of the Edict of Nantz. They brought with them a knowledge of many branches of the arts still unknown, and introduced many improvements on those with which they were previously acquainted. From this era, we may date the rise of the linen manufacture in this kingdom.

As yet we have said nothing of weaving, so far as the cotton manufacture is concerned. To its history, therefore, we will now turn, as it is intended to constitute the principal object of this article. It is well known to have had its origin in the East, the country where the cotton plant is indigenous. Its light and absorbent fabric must have early recommended it as a clothing suitable to the warmth of the climate. Hence, from the earliest ages, India has been celebrated for this kind of cloth, large quantities of it being annually imported into Europe. Notwithstanding this, however, and although they stand unrivalled, even by British manufactures, their implements are rude and simple; being evidently the invention of an early era. This absence of improvement is to be accounted for, by the undeviating adherence to established use and practice; the son invariably following the occupation of the father, precluding all developement of talent, and reducing man to a mere machine.

The fitting out of an Indian weaver is certainly of no great expense; all his implements, necessary from the cleaning of the wool to the converting of it into the finest muslin, not exceeding in value a few shillings. Their yarn is spun upon the distaff; being, notwithstanding all our improvements in machinery, superior in fineness and quality, and retaining its appearance longer, than any that we can produce. This is not owing to the material being of a better quality, since no cotton that India can produce is equal in quality to the best Sea Island: it is to be ascribed to the skilful tact of the workmen, the well managed finger of the Indian spinner, carefully and patiently applied to the formation of the thread, and the moisture at the same time communicated to it, having the effect of incorporating the fibres of the cotton more perfectly than can be accomplished by our machines.

The loom upon which the cloth is woven, is composed of a few sticks or reeds, which the weaver carries about with him, erecting it in the field, under the shade of a tree, digging a hole large enough to contain his legs and the lower part of the "geer;" the balances of which he fastens to some conveient branch over his head. Two loops underneath the *geer*, in which he inserts his toes, serve as treddles; and the shuttle, formed like a large netting-needle, but of a length somewhat exceeding the web in breadth, he employs also as a "batton," using it alternately to draw through the weft, and strike it up. There is no beam to the loom; but the cloth is laid out on ground, the whole length of the piece. It is on this account that weavers are obliged to carry on their work out of doors, and to live in villages; building their houses beneath the shade of the tamarind, and the mango tree. The reed is the only part of the apparatus, that approaches in perfection the instruments we use. It is with this rude, and ill constructed loom, that the Indian produces those muslins, which have long been such objects of curiosity, from the exquisite beauty and fineness of their texture, so as when spread on the grass to resemble the web of the gossamer. It is not every one, however, who is capable of producing these fabrics; such a dexterity and slight of hand being required, which few out of the multitude are capable of acquiring.

Notwithstanding the superiority of the people of India in this art, it has had no effect in improving the condition of the people. It does not even afford the capital necessary to its own existence, the funds which keep this branch of industry in motion being supplied not by the master manufacturer, but by the East India Company, the purchaser of the goods.

Common muslins are made in every village of the Peninsula. It is at Dacca that those fabrics are produced of such exquisite fineness as to realize the idea of the poet of "*webs of woven wind.*" The long cloths and fine pullicates are made chiefly within the presidency of Madras; the coarse piece goods and pullicates at Surat; the finest calicoes at Masulipatam, and table-cloths at Patna.

Before concluding this account of the Indian cotton manufacture, it may be mentioned that of late a revolution has taken place in our trade with that country. The introduction of machinery has enabled us to reduce the price of our manufactures so much that we are enabled successfully to compete with India goods in those markets which formerly it exclusively supplied, and even export them to India itself. At the commencement of our intercourse with that country, our home investments were principally manufactured produce. Now, however, it is made up of the produce of the soil, such as indigo, cotton, raw silk, &c. We can easily imagine how materially such a change must operate on a crowded population, which has ever been a great manufacturing and exporting community.

As to the cotton manufacture of China, the only goods of that description exported by the East India Company are nankeens and a few chintzes. The tint which the former of these has, naturally belongs to the cotton of which it is made, and is not given by artificial means. As for the Chinese themselves, about 9-10ths of their immense population are clothed in cotton. It is usually worn coloured, white being the dress worn during seasons of mourning, and on no other occasion.

In our next essay we shall bring down the history of the cotton manufacture from its introduction into Europe, to our own times, noticing as we go along each invention and improvement.

ON THE SMELTING OF IRON ORE.

Read before the Glasgow Philosophical Society, by Mr. J. B. Nelson, Engineer.

[Communicated by the Author.]

Mr. President,—This well-known metal, on the smelting the ore of which I mean to make a few observations, is decidedly of all others the most useful and the most indispensible to man, and is more generally and more abundantly diffused throughout nature than any other. Under a variety of forms, it is found in the earth, combined with numerous other substances, both earthy and metallic. The waters of many springs are impregnated with it. It is present in a great many vegetable products, and is found in their ashes after they are burnt. Very few fossils are free from it; and it is the principle on which their colours generally depend. It is a constituent principle of the blood, and of several other animal fluids and solids.

A considerable difference of opinion has prevailed among mineralogists with regard to the existence of native iron, which, at any rate, is scarce. It has been found, however, in masses, in Siberia, and in the internal parts of America; and, very lately, a large mass of native iron was found in Louisiana, which is now in the museum at New York. There can be no doubt, however, that these masses are of the same nature with those which, it has been established on the most ample and positive testimony, have fallen from the atmosphere, in different countries, at various times. Whatever, therefore, may have been the origin of the meteoric iron, the masses of Siberia and of America, there is every reason to believe, had the same origin. Native iron, in a malleable state, has been likewise said to have been found imbedded n some iron ores in Saxony; but of this there still remains considerable doubt.

It is not very easy to say when the first knowledge of iron was obtained, or what first led to it; but it is not at all improbable that it arose from the discovery of some of these meteoric masses which had fallen from the atmosphere. The capability which the iron in these masses possess of being hammered into shape, may have first led to a knowledge of the valuable properties of that metal, which has since become so important to mankind; and which has tended so much to the advancement of every useful and every elegant art. Tradition, which, however, lends but a feeble ray to light us in any attempt to penetrate the darkness which envelopes our knowledge of remote ages, has informed us that the discovery took place accidentally in Greece, in consequence of the burning of a wood; and when we consider how accidentally the first knowledge of many things the most important to man has been obtained, this is certainly not improbable.—We know that iron ore is to be found on the surface of the earth; and the intense heat created by the burning of a forest may have melted the ore, and left among the ashes portions of iron in a malleable state. It is equally probable, however, that it may have been first obtained in the course of the process of making charcoal; masses of iron ore intermixed with lime may have been in the covering matter of the charcoal; a portion of this may have fallen among the ignited fuel; an increased current of air may have accidentally arisen, thereby causing a heat sufficiently intense, and while the charcoal would be destroyed, iron would be brought into existence. The similarity of the substance thus obtained to meteoric iron, would lead to the experiment of applying it to similar purposes: and the benefits thus unintentionally obtained, would lead, with a view to beneficial results, to a repetition of that process, which, when it first accidentally occurred, was considered as a calamity.

If we are in the dark with regard to the discovery of iron, we are equally so as to the furnaces at first used in smelting it; and it would be ridiculous, as it is impossible, to say what was the form or shape at first used. But, if the conjectures which have been advanced, be grounded in truth, we may presume that a knowledge of the air-bloomery furnace, which is the earliest we know of, may have thus arisen. It appears, indeed, for a long period, to have been the only form used: in Spain, and on the shores of the Mediterranean, it is still used, where Elba ore is fused to a considerable extent. Although there is reason to be certain that furnaces on this construction existed in our own country, nothing is known either of their plan or of their extent. One of our most eminent African travellers, however, gives us an account of those he saw in use in Africa: he describes them as conical, of narrow limits, small opening for admitting the air, and for allowing the combustible products to escape.

The ore used in these furnaces required to be very rich in order to give beneficial results. The iron is produced by the deoxidation of the ore, which takes place by its being in contact with ignited charcoal; and till the metallic particles of iron begin to be separated, it must be kept as much as possible from the contact of air; and an increased temperature is then necessary to unite the metallic particles into masses. These masses, which, when taken out, are combined with its earthy parts in a state of scoria, are then hammered into blooms, and afterwards they are reheated, and hammered into the different forms necessary for the purposes to which they are intended to be applied.

This process would be attended with uncertainty, and from the changes of temperature and season, at times would not go on at all.—When it was necessary for the temperature to be increased to unite the metal into masses after deoxidation, the current of air might fall off, and thus stop the process from going on. This would lead to some means of producing a regular and increased current of air; and the first application of the bellows to this design, is a very important step in the progress of this art. It is probable that when first used, they would only be applied in the second part of the process, in order to produce the heat necessary to combine the metallic particles into masses; but time and experience would lead to the knowledge of the important advantages to be derived from the use of the bellows, though these must have been the result of labour and perseverance—the nursing parents of improvement.

The blast bloomery furnace which came next into use, must be considered as a most important revolution in the art of making iron; and as having been of incalculable advantage to mankind. In the air-bloomery, the ore being in contact with the charcoal was deprived of its oxygen, and afterwards, as we have stated, by the influence of an increased temperature, was run into ductile iron; in the blast-bloomery, however, not only was the ore deprived of its oxygen, but by the uniform and increased temperature, occasioned by the blast, the iron combined with the charcoal, which would produce fusibility, and crude cast-iron, now so much improved and so wonderfully employed in the aggrandisement of our country, would be produced. The soft and ductile iron produced by the air-bloomery, would, by this process, disappear, and a fluid metal would be the result, perfectly different in its properties from the other, and which would go to pieces under the hammer. This result, so different from what would at first be expected, would often have the effect of causing the bellows to be laid aside for a time, until chance, or some more intelligent smith than another, would find, in the course of frequent attempts to hammer this iron, that it in time got better. It would soon occur, or be discovered, that directing the blast down upon the surface of the metal while it was yet in the furnace, would have the same effect, and would, therefore, shorten the method of obtaining the ductile instead of the cast iron. Thus a new form of furnaces would be constructed; and hence resulted the blast-bloomery.

The blast-bloomery furnaces in this country were either square or round, and from three to four feet high. Although the waste of ore was not so great as in the air-bloomery, yet the blast-bloomery was very imperfect, and there was still a very considerable waste. The amount of this may be estimated from the quantity of iron still remaining in the slags, found in this country, and known by the name of Roman or Danish cinders, which were the product of blast-bloomery furnaces; these slags contained on an average 40 per cent. of iron, and were used extensively for a considerable period as ores in the blast-furnaces of this country.

The next step in improvement in the art of making iron, was the blast-furnace which is now in use; and from which foundries, forges, and finery-furnaces must have resulted. Great benefits have arisen from the use of the blast-furnace; from the continued process of reduction, a complete separation of the iron from the ore is effected, thus giving a greatly increased quantity of iron in a far less time, and with less expense of fuel; and by having received a greater doze of carbon, it becomes more fluid, falls below the blast, remains in the bottom of the furnace, whence at particular times, it can be run into pig beds made in the sand. By this additional doze of carbon, however, it would be found to be quite unfit for the hammer, or be made into blooms; but as a particular direction of the blast, in the blast-bloomery, was found to render the metal ductile, this principle could be applied in the new mode of manufacturing iron. It would immediately appear, that this operation could be performed in another furnace, without having any connection with the previous smelting.—This would lead to the erection of the finery-furnace, where the crude iron goes through the process of decarbonization, from which it is taken to the puddling-furnace, where this process is completed.

It is not exactly known when the blast-furnaces were first introduced into this country. No facts exist even in Dean Forest, the most ancient place for making iron in Britain, as to this: neither is it known whether it is a native invention, or one imported from abroad.

In James the First's reign, the iron trade is said to have been extensive; however, it fell greatly to decay afterwards, owing to the want of wood. In Queen Elisabeth's reign it must have been very extensive, owing to the quantity of heavy ordnance then in demand. The dissensions between the houses of York and Lancaster must have tended to injure very much improvements in science, during the period they subsisted. It is, however, supposed that the blast-furnace was used in the reign of Henry the Seventh. The sites of them are found near small streams, for the purpose, it would appear, of obtaining water power for the bellows. The scarcity of wood would lead their attention, no doubt, to obtaining a substitute likely to supply its place; and pit-coal would appear to be the only one. In the time of James the First, many patents were granted for making iron with pit-coal, but these attempts, it would appear, had failed. Other patents were granted in the reign of Charles the Second, but it appears that it was not until about the year 1750 that pit-coal became a complete substitute for wood char. These attempts, no doubt, failed from the blast not being powerful enough; this was overcome, however, by the advancement of science, and as hand bellows gave place to those driven by water, this in its turn gave way to the steam engine, that most powerful agent in the hands of man.

Having thus traced the manufacturing of iron from the period of traditional uncertainty, through the many stages it has gone, to the present day; and having traced its progress from the making of ductile iron to the advanced state in which the art now is, I have more particularly to direct your attention to the subject of the present essay, which is as to some of the defects at present existing in the making of the pure carburet of iron. We must admit that, with all the skill which we possess, derived from experience and from scientific research, and notwithstanding all the advantages and knowledge we possess over our forefathers, we are still ignorant of the cause of many disadvantages and imperfections which a number of the most important of the arts labour under, and, consequently, we are unable to make any attempt for their removal. Notwithstanding the progress which has been made in the art of manufacturing iron, those acquainted with it, know there are still many imperfections to be remedied, and many disadvantages to be removed, could the cause of them be completely ascertained.

Long experience has shown, that furnaces for smelting of iron ore into pig-iron, produce, during the summer months, far less iron, and that of an inferior quality, in the same given time, with the same power and an equal quantity of ore, than they do in the winter months. As to the cause of this, I have formed an opinion, you will observe, rather different from the one generally entertained.

It has been said to arise from sulphur in the air, in the summer months; and I, having been asked, if it was not possible to purify it, as we do carburretted hydrogen gas, was led, from this, more particularly to investigate the subject. I was soon, however, convinced that this was not the cause; and I think the real cause has never yet been pointed out.

I need not explain to you how powerful an agent throughout nature oxygen is, nor need I mention how necessary it is to animal life, as well as to supporting combustion. These are matters with which you are perfectly familiar.

But what I have now to suggest is, that the cause of the imperfection I have mentioned in the smelting of iron ore, is the want of a due proportion of oxygen, in the air blown into the furnaces during the heat of the summer months. It is quite clear, that when the air is rarified by the heat of summer, and this we know to be the case, it cannot contain the same quantity of oxygen in the same volume; and when we consider how necessary oxygen is to perfect combustion, it is impossible, I should think, not to feel the truth of what I have stated. We all know, that during the summer months, the fires in houses do not burn so intensely as in winter; now this clearly arises from the same cause—the want of oxygen; and of course the greater quantity of oxygen which can be thrown in, the more intense will be the heat of the fire or furnaces. From this it is evident that the greater volume of air we can throw in, the better; because the greater will be the quantity of oxygen which it contains. This is confirmed by the experiments made by Mr. Roebuck, many years ago, at Devon Iron-Works. He, from the results of his various experiments, assumed it as a principle, that a greater quantity of air thrown into the furnace, with less velocity, was much better than a less quantity thrown in with greater velocity; and, that every thing else being equal, a greater quantity of iron, and of better quality, would be obtained from the same quantity and quality of ore, with a less consumption of fuel.—But it is only by actual experiment that the power, quantity, and velocity, can be ascertained, which will give the maximum effect.

A person in England has made a blowing-machine, for which he has received a patent, two of which are at work in this town. One at Mr. Edington's, Phœnix Foundry, and the other at Mr. Dunn's, in John-Street.

The patentee has here, with rather a rude kind of machine, availed himself of Mr. Roebuck's assumed principle; which is, that it is more advantageous to throw in a greater quantity of air with less velocity, than a smaller quantity with greater velocity; and I believe the machine, rude as it is, has given very satisfactory results, as to the quality of the iron, the speed of fusion, and the saving of fuel.

Some of our iron manufacturers, with the intention of trying the principle, widened the mouth of their blow-pipe, without increasing the size of the rest of the apparatus. This experiment, as was to be expected, did not succeed, because, although by widening the blow-pipe, the velocity was decreased, no means were used for encreasing the quantity of air.

Although Mr. Roebuck, when he lays down the principle above alluded to, does not hint at the cause of this, it is abundantly clear that it arises from the additional quantity of oxygen, which is thus supplied; and it gives a strong argument in favour of what I have stated as the cause of the difficulty of obtaining good pig-iron in any quantity during the summer.—However, in order clearly to establish what I have said, I will now proceed to make a few calculations, to show, how, during the summer, the proportion of oxygen is awanting, which is so necessary to support perfect combustion. The air is an elastic fluid, which expands by heat and contracts by cold. Let us suppose, then, for example, a cylinder 7 feet in diameter with a stroke of 8 feet, making 13 strokes per minute. Then diameter $7^2 \times .7854 =$ area of cylinder $= 38.4846$. Stroke $8 \times 38.4846 =$ cubic feet in each single stroke $= 307.8768$. 13 double, 26 single strokes per minute $\times\ 307.8768 =$ cubic feet of air thrown into the furnaces per minute $= 8004.776$, making iron of a good quality in the winter months, when the thermometer is at, say 32°. Now if, upon the other hand, we suppose the air, during the summer months to be at 70°, there will be an increase of volume as 448 + the temperature Fah.; and the proportion between the air at this heat, and when at 32° will be as 448 + 32° : 448 + 70, or as 480 : 518. This proportion will be then as 448 : 518 : : 8004.776 : 8638.487; and therefore, before the same quantity of oxygen can be thrown into the furnaces during the summer, there must be an increase of quantity of 633.711 cubic feet of air per minute; 38022.66 in one hour; and 456271.92 cubic feet in twelve hours. So that, unless this additional quantity be thrown into the furnaces, the same quantity of oxygen will not be supplied; and as the cylinder can throw no greater quantity into the furnaces at one season than at another, the loss of oxygen, when the air is expanded by the heat of summer, will be 91254.72 cubic feet in twelve hours.

I think, therefore, from what has been stated, there is strong reason to believe that it is the want of a due quantity of oxygen during the summer months, which is the principle cause of furnaces during that time not producing iron equal either in quantity or quality to what they do in the winter months.

There is another cause, however, productive likewise of considerable injury, which arises from the construction of the water vaults for equalizing the blast. The air during summer being of a higher temperature than the water in the vault, absorbs a considerable portion of moisture from the water, which being blown along with the air into the furnace, tends to injure the combustion. This was fully established by experiments made at Clyde Iron Works, where, by applying a cooling mixture to the blow-pipe, just before it enters the furnace, a constant stream of water was obtained from the moisture contained in the air.

MARK KIDD'S MODEL OF A SEVENTY-FOUR GUN SHIP.

In an early Number of our Magazine, we took occasion to call the attention of our readers to a very curious and interesting subject—a model of a 74 gun ship, constructed by a blind man. This singular display of mechanical ingenuity is recorded in No. XI. Vol. I.; and to that, for the purpose of avoiding repetition, we beg at present to refer. At the time that Number was published, Mr. Kidd's vessel was merely in progress; but, within these few days, it has been brought to a state of completion. As soon as we heard of its being finished, we lost no time in going to see it —for who would be slack in going to survey the result of seven years' occasional labour, whether performed by the blind or the seeing? The object, whatever it be, that may have occupied the attention of any man during so great a portion of his life as seven years, cannot but be worthy of some degree of notice; for, if it should not always be an indication of taste or of ingenuity, it must at least be a proof of patience and perseverance; and, for either great mental or manual achievements, the latter are often not less requisite than the former. We went, therefore, to Mr. Kidd's, not merely to see and to wonder, but also to receive an important lesson. A more interesting display of human genius we have never had the fortune to witness; and we felt, on the occasion, emotions of awe and respect, such as we remember to have felt the first time we heard those, to whom nature had denied the powers of hearing, attempt to articulate words. What mechanical achievement, of any kind, on the part of a blind man, could fail to excite admiration in the breast of the feeling and contemplative? That admiration must be doubly intense, when the achievement, under consideration, is a model of a 74 gun ship, regularly built, completely rigged, well proportioned, with nothing superfluous, and yet deficient in nothing that usually pertains to an ordinary vessel. How Mr. Kidd acquired his accurate knowledge of naval architecture, and how, when that knowledge was acquired, he learned to apply it to practical purposes, we cannot pretend to say; but we have had the most satisfactory evidence, that every thing connected with the ship in question, except the painting, was executed by himself. His scientific skill is abundantly displayed by the facility with which he gives the name, and tells the use, of every part. If a man is ever to be proud of having succeeded in an arduous undertaking—of having overcome difficulties which to most would seem insurmountable—of having, by patience and perseverance, accomplished what almost none would have had the courage to attempt—well may Mr. Kidd contemplate, with feelings of complacency and self-gratulation, this miniature of British thunder, as it at present lies, as if ready to be launched upon the spreading ocean, to hurl destruction against some haughty and daring foe.

Now that Mr. Kidd has got his seven years' task completed, he wishes to turn it to some pecuniary advantage. How this is to be best accomplished, is to him a subject of much importance. We have given it as our advice, and we hope it will not be neglected, that he should take a room, in some convenient part of the town, and exhibit it as a curiosity. After having gratified his fellow-citizens with a view, he might remove it to some other town, for the purpose of exhibition. After a few exhibitions of this kind, we have no doubt but some private gentleman will be ready to purchase it as an ornament for his lobby, or some society, as a curiosity to deposit in a museum. Should Mr. Kidd follow our advice, which, from his circumstances and situation in life, no feelings of delicacy need prevent, we are sure he will meet with the encouragement which his genius deserves. Many times, we can assure our readers, is a shilling or a sixpence expended to procure the sight of a much more trifling object. Were our country not as distinguished by her parsimony to the living as by her prodigality to the dead, we are certain Mr. Kidd's appeal to public sympathy would not be in vain. But, even as things are, we are confident his merits will be duly appreciated and duly rewarded. To a country like ours, whose wealth and prosperity depend mainly upon the results of mechanical ingenuity, and whose very existence, as a nation, depends perhaps upon her naval power, what can be an object of greater interest than a model of a 74 gun ship, made by a man entirely blind? To the man of sensibility, who bewails the hard fate of genius languishing in obscurity, and deplores the many difficulties against which it is generally doomed to struggle, we deem it unnecessary to say a word upon this subject. To the philosopher, who contemplates the resources of nature in compensating the deficiency of one organ by the superior activity of another, the best appeal that can be made is, simply to state the fact, that a vessel in miniature, with all her appendages, has been constructed by the hand of a blind man.

If any thing we have advanced on this subject prove beneficial to Mr. Kidd, we shall have the pleasure of thinking that he is not the first individual to whose modest merits we have attracted public attention.

OBSERVATIONS ON MR. SAUL'S IMPROVED WINDOW.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—In No. LX. Vol. III. of your Magazine, you have given a drawing and description of an elegant shop front, from a design by a Mr. Saul, of Lancaster, together with a sliding shutter, that sinks into the ground outside the window, and saves the trouble of taking down or putting up a great number of divisions of a shutter in the old way. We are certainly obliged to Mr. Saul for his communication; but, at the same time, it is but justice to Messrs. William and James Carswell, builders in this city, to say that these improved shop fronts, and outside sliding shutters, hung by chains over very large pullies, and counterpoised, have been used, and put up by them, at least twenty-five years ago, and are to be seen in those buildings foot of Candlerigg-Street, and Candlerigg-Court, built by them, and in many other places of this great city. The introduction of shop fronts, entirely of cast-iron, by Messrs. Carswell, has given rise to many useful and elegant improvements in shops, staircases, and other buildings.

I am, Gentlemen, yours, &c.

J. P.

Glasgow, 21st February, 1825.

MR. FULTON AND MR. HENRY BELL.

Gentlemen,—Having observed, in No. LVIII. Vol. II. of the Glasgow Mechanics' Magazine, an extract from the Fifth Report of the House of Commons on the subject of Steam Navigation, I should be glad if you, or any of your Correspondents, could inform me of what country Mr. Fulton was a native? I find that, in Chapman's Picture of Glasgow for 1820, Mr. Fulton is called a *North American*; but, in the Quarterly Review, if I am not much mistaken, as I speak only from recollection, Mr. Fulton is stated to be a *native of Glasgow*. I do not remember the Number of the Quarterly, but it will be found in the Index to it. It is very probable Mr. Henry Bell could answer this query. It is also mentioned, in the Picture of Glasgow, that Mr. Fulton launched a steam boat on the river Hudson, 3d October, 1807. Mr. Bell says—"in 1811 I built the Comet,"—which certainly was the first effective steam boat in Great Britain. Mr. Bell "gave the first model to Mr. Fulton, and went over to America to assist him in establishing them." Mr. Bell must have gone over before 1807. The merit of constructing steam boats is certainly due to Mr. Bell—or rather of bringing them into effective use—as Mr. Symington, in 1801, tried the power of a steam boat on the Forth and Clyde Canal. But Mr. Bell must, I believe, be considered as the "father of the steam boat." Any light that can be thrown on these subjects will probably gratify a number of your readers, and, among others, a sincere well-wisher to the success of your excellent Magazine.

J. M.

NOTICES TO CORRESPONDENTS.

We shall be happy to hear from "A Friend to the Circulation of Knowledge" in Edinburgh, on the subject he mentions.—We have received a letter from Veritas, in which he states, that notwithstanding Mr. Warren has denied he had ever any intention of commencing a Class for Mechanical Drawing, his name is mentioned in the Edinburgh Alamanack as being Professor of that art. We decline, however, inserting the letter, as the writer, whoever he may be, is by no means entitled to make the assumption he does, unless he can establish that Mr. W. knew of, and authorised his name to be inserted in the Edinburgh Almanack.

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THE GLASGOW

MECHANICS' MAGAZINE,

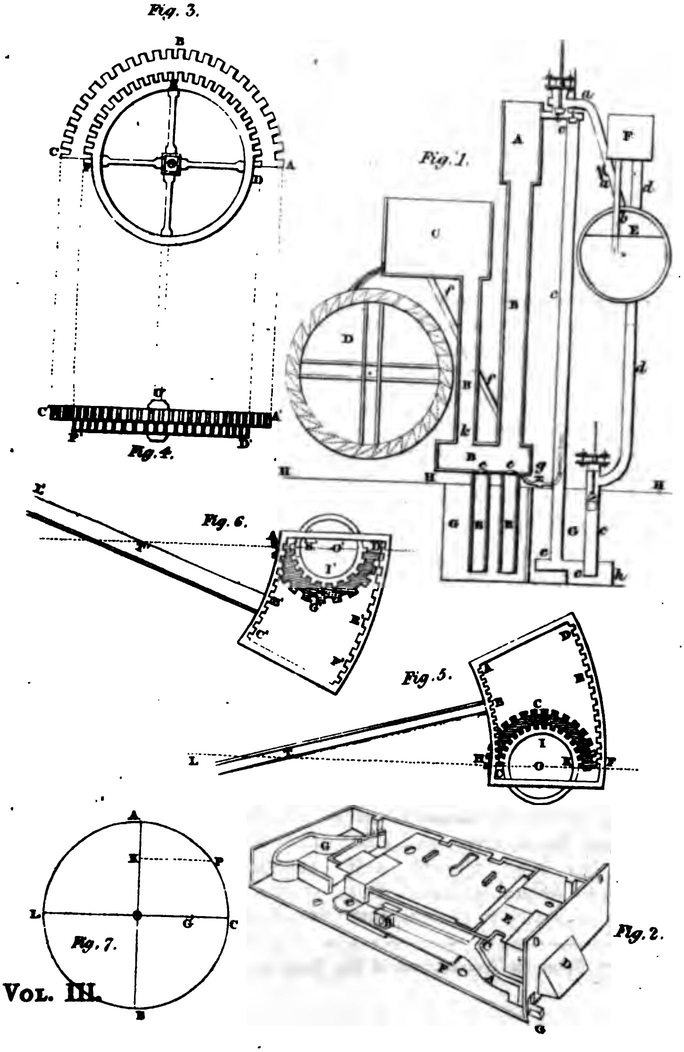
CONDUCTED BY

A Committee of Civil Engineers and Practical Mechanics.

> " How charming is divine philosophy!
> Not harsh and crabbed as dull fools suppose;
> But musical as is Apollo's lute
> And a perpetual feast of nectar'd sweets,
> Where no crude surfeit reigns!"

No. LXII. *Saturday*, 5*th March*, 1825. Price 3*d*.

NANCARROW'S STEAM ENGINE, IMPROVED LOCK, &c.



Vol. III.

— Swan Sc —

DESCRIPTION OF A STEAM ENGINE, INTENDED TO GIVE MOTION TO WATER-WHEELS, IN PLACES WHERE THERE IS NO FALL, AND BUT A VERY SMALL STREAM OR SPRING.

By John Nancarrow.*

A, (Figure 1,) the receiver, which may be made either of wood or iron.

B, B, B, B, B, wooden or cast-iron pipes, for conveying the water to the receiver, and thence to the penstock.

C, the penstock or cistern.

D, the water-wheel.

E, the boiler, which may be either iron or copper.

F, the hot well for supplying the boiler with water.

G, G, two cisterns under the level of the water, in which the small bores B, B, and the condenser are contained.

H, H, H, the surface of the water with which the steam-engine and the water-wheel are supplied.

a, *a*, the steam-pipe, through which the steam is conveyed from the boiler to the receiver.

b, the feeding-pipe, for supplying the boiler with hot water.

c, *c*, *c*, *c*, *c*, the condensing apparatus.

d, *d*, the pipe which conveys the hot water from the condenser to the hot well.

e, *e*, *i*, valves for admitting and excluding the water.

f, *f*, the injection-pipe, and *g* the injection-cock.

h, the condenser.

It does not appear necessary to say any thing here on the manner in which this machine performs its operations without manual assistance, as the method of opening the cocks, by which the steam is admitted into the receiver, and condensed, has been already well described by several writers. But it will be necessary to remark, that the receiver, penstock, and all the pipes, must be previously filled before any water can be delivered on the wheel; and when the steam in the boiler has acquired a sufficient strength, the valve at *i* is opened, and the steam immediately rushes from the boiler at E into the receiver A; the water descends through the tubes A and B, and ascends through the valve *k*, and the other pipe or tube B, into the penstock C. This part of the operation being performed, and the valve *i* shut, that at *l* is suddenly opened, through which the steam rushes down the condensing-pipe *c*, and in its passage meets with a jet of cold water from the injection-cock *g*, by which it is condensed. A vacuum being made by this means in the receiver, the water is driven up to fill it a second time through the valves *e*, *e*, by the pressure of the external air, when the steam-valve at *i* is again opened, and the operation repeated for any length of time the machine is required to work.

There are many advantages which a steam-engine on this construction possesses beyond any thing of the kind hitherto invented; a few of which I shall beg leave to enumerate.

1. It is subject to little or no friction.

2. It may be erected at a small expense when compared with any other sort of steam-engine.

3. It has every advantage which may be attributed to Boulton and Watt's engines, by condensing out of the receiver, either in the penstock or at the level of the water.

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* From the Transactions of the American Philosophical Society.

4. Another very great advantage is, that the water in the upper part of the pipe adjoining the receiver acquires a heat, by its being in frequent contact with the steam, very nearly equal to that of boiling water; hence the receiver is always kept uniformly hot, as in the case of Boulton and Watt's engines.

5. A very small stream of water is sufficient to supply this engine, (even where there is no fall,) for all the water raised by it is returned into the reservoir H, H, H.

From the foregoing reasons it manifestly appears, that no kind of steam-engine is so well adapted to give rotatory motion to machinery of every kind as this. Its form is simple, and the materials of which it is composed are cheap; the power is more than equal to any other machine of the kind, because there is no deduction to be made for friction, except on account of turning the cocks, which is but trifling.

Its great utility is therefore evident in supplying water for every kind of work performed by a water-wheel, such as grist-mills, saw-mills, blast-furnaces, forges, &c.

AN IMPROVED DRAWBACK LOCK FOR HOUSE-DOORS.

FIG. 2 is an improved Drawback Lock for house-doors, &c. In damp weather, it is well known that the air drawing through the lock rusts the head or bevel of the bolt, by which means it requires great force to shut the door, and occasions a disagreeable noise, besides shaking the building. Owing to the difficulty thence arising in shutting the door on the latch, houses are often exposed to robbery by the door being left unlatched, when it is supposed to be fast. In this improved lock, these inconveniences are removed, as it allows the bolt to shoot into the staple immediately when the door closes, but not before; and the reliever works so very easy, that the door is made fast with one twenty-fourth part of the force required with locks upon the common construction.

Description.

Fig. 2. A, is the new iron latch here affixed to an old common drawback house lock.

B, an iron pin at one end of the latch, on which pin it is moveable.

C, a projecting part of the latch, which, when the common spring bolt D of the lock is drawn back, in the usual manner, is forced into the nick on its higher part at E, by the spring F, underneath the latch.

The bolt D then remains within the lock, until, on closing the door, the reliever, G, gently presses on the lock-box, fixed in the common way on the door cheek; which pressure draws the projecting part C out of the nick E, and permits the end of the bolt D, by the force of the spring G, to slide into the lock-box, and fasten the door.

ON THE LOSS OF POWER ARISING FROM THE USE OF THE CRANK.

To the Editors of the
GLASGOW MECHANICS' MAGAZINE.

GENTLEMEN,—The following observations, on the loss of power occasioned by the use of a crank, lead to a result different from any that I have seen; which, therefore, however obvious they appear to myself, I offer with some hesitation, as I have not attempted to confirm them by experiment.

Let a crank, in its revolution,

describe the circle A, C, L, (see fig. 7,) and let the connecting rod move in a vertical line; it is obvious, when the crank is in the position C, that the whole power is exerted in turning the machinery; but in any other position the power is applied at a mechanical disadvantage, and in the vertical points, A and B, no power is communicated. In determining the loss of power, for the sake of simplicity, an infinite number of cranks may be supposed to act around the circumference A, C, B; and it is obvious that, while the friction and atmospheric resistance are the same, there will be exactly the same loss of power, whatever be the number of cranks, provided the motion be uniform in every case. But the same result will evidently be obtained, if, instead of cranks, a number of equal weights be attached at every point in the arc A, C, B, exerting a power equal to the cranks. Now, the effect produced by any one of these weights, acting at any point P, is proportional to P, K, its distance from the vertical line A, B; and hence the effect produced by all the weights will be the same as if they acted in the point G, the centre of gravity of the arc A, C, B. But if they acted at C, instead of G, the circular motion continuing the same, their effect would be increased in the ratio of O, G, to O, C. Now, O, G, is about two-thirds of O, C; hence the whole power employed is to the efficient power as 3 to 2, or about one-third of the power is rendered ineffective by employing a crank.

When only one crank is used, there is another obvious disadvantage attending it—the irregularity of the motion. This irregularity occasions a farther loss of power, as every machine must have a certain determinate motion to produce the greatest effect; and, therefore, any irregularity of motion must cause a diminution of effect. When a fly-wheel is employed to produce a more uniform motion, power is also lost in overcoming the friction and resistance of the fly. The momentum which the fly-wheel loses by resistance and friction must be again restored to it by the machinery, when the crank is acting in its most favourable position.

If the power could constantly be communicated at the point C, the effect would be increased one-half. The following contrivance appears to accomplish this object:—

A, B, C, and D, E, F, are two semicircular arcs, whose centres lye in the axis of the wheel E, D, F, fig. 3, and are both provided with the same number of teeth. In fig. 4, another view is given, perpendicular to the former. In fig. 5, L, B, is a lever, and O, T, the point about which it moves. A, C, and D, F, are two circular arcs, having their centres in T, and of the same length with the semicircular arcs C, T, K, H, G, F, and are also furnished with the same number of teeth. When the machine is in the position represented in fig. 5, and the wheel K, T, C, moves in the direction K, T, the interior teeth K, T, C, act upon the teeth A, B, C; and, after a half revolution of the wheel, the machine will be in the position shown in fig. 6. The interior teeth having now passed the teeth A′, B′, C′, the exterior teeth A′, G′, D′, will now act upon the teeth of the larger arc D′, E′, F′; and, after another half revolution of the wheel, the machine will have regained its former position in fig. 5. The same motion will continue during the successive revolutions of the wheel. If the lever be supposed to act, the same motion will take place.

Since the motion is communicated at C, and F,—points in the line of centres T, O, F,—no power is lost; and since, by the construction, $\frac{O, F,}{O, K,} = \frac{H, G, F,}{C, T, K,} = \frac{D, F,}{A, C,} = \frac{T, E,}{T, B,}$ the motion will be uniform.

It appears, from what was stated before, when a crank is employed in communicating motion from a wheel to a lever, that the motion is irregular; there is also about one-third of the power employed lost. By employing a fly-wheel, or several levers, the former defect may be remedied, but the latter still exists. By the above method, both these defects are remedied; the whole power employed is effective, and a perfect uniformity of motion is obtained. There is still a loss, however, from friction and the momentum of the lever, but these are also common to the crank.

This contrivance occurred to me more than two years ago, and I am ignorant if any such method has yet been proposed.

I am, GENTLEMEN, yours, &c.

A. B.

Dollar, 14th Feb. 1825.

ON POPULAR EDUCATION.*

THE most distinctive mark of the present age, and that which will point it out to after ages above even the splendour of its literature, and the wonders of its scientific discoveries, is that thirst for knowledge which pervades the working classes of the people, and the enthusiasm with which the rich and the wealthy lend their aid in enabling them to satisfy their praise-worthy desire. Not many years ago, the great majority of the people were utterly regardless of any thing more than merely the rudiments of education. There were no doubt exceptions, great and glorious exceptions, to this; but take the people of Great Britain altogether, there seemed very little desire among them to acquire any other knowledge. On the other hand, there seemed a desire on the part of the wealthy and the learned to prevent their ever acquiring knowledge, or even a desire for it; and men, otherwise good and valuable members of society, resisted, with all their talent and influence, any attempt to instruct or improve the poorer portion of their brethren. Times, however, have most happily changed. A noble desire pervades the breasts of the poorest of our citizens to acquire useful knowledge; and a praise-worthy spirit is every where abroad among those whom providence has been pleased to bless with a greater portion of wealth, to aid them in their honest desire.

We are extremely happy to see this pamphlet of Mr. Brougham's (which was originally published in the pages of the Edinburgh Review) now given to the world separately. The wisdom and philanthropy which its views exhibit, the powerful manner in which it advocates the cause of popular education, and the excellence of the many plans it developes and explains for the furtherance of this great object, entitle it to be universally read; and great as is the circulation of the Edinburgh Review, it is much too limited for such a pamphlet as the present. We sincerely trust that it will not be uninfluential, but that it will have the effect of persuading numbers of the working classes to join their brethren in their attempts to obtain the greatest of all human blessings—knowledge and instruction; and that it will excite many rich men to co-operate with those who are already lending their steady support to the promotion of so useful an object.

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* Practical Observations on the Education of the People. Addressed to the Working Classes and their Employers. By Henry Brougham, Esq. M. P. F. R. S.

The example of such a man as Mr. Brougham must be of incalculable benefit to the design; for what can more excite any man to lend his assistance, than seeing one so famed as he labouring in the cause. Mr. Brougham has probably the most powerful mind of any man now alive. At the bar he is decidedly without a rival; and in the senate-house, who can stand before the thunder of his voice or the lightning of his eye? Mr. Scarlet, with all his legal learning, is but as a child in the hands of Mr. Brougham, when they are opposed to each other in one of the courts; and exquisitely keen and rapid as are the shafts of Mr. Canning's wit, and brilliant as are the flashes and corruscations of his genius, they are perfectly powerless in their effects on Mr. Brougham. Mr. Canning is decidedly a man of genius, and his eloquence must always please and delight his hearers; but Mr. Brougham, whether he pleases or not, must always convince—always overcome. If there ever was a man who possessed the greatest of all the qualifications an orator can possess — power, irresistible, overwhelming power—it is Mr. Brougham: and although as a lawyer and statesman, an orator and a philosopher, his name will descend to posterity, one of the brightest gems in the diadem which an after people will place on his head will undoubtedly arise from the efforts he has unremittingly made to promote popular education.

It is quite impossible that in our limited pages we can enter into a complete analysis of the whole of this excellent pamphlet; we must content ourselves with a few extracts, with enforcing a few of the topics it embraces, and with earnestly recommending to our readers the perusal of the pamphlet itself, a thing they will be more likely to do when we inform them, that it is published for behoof of the London Mechanics' Institution. What he advances in the following extract, is surely deserving of attention from every one; and we know nothing which will prove of more advantage to the cause of popular education, than the publication of good popular treatises on different subjects connected with science and the arts, such as he proposes. The idea of a society such as he mentions for the promotion of this purpose is praiseworthy, and it is much to be hoped that the design of forming it will not be allowed to fall to the ground.

"In the *third* place, (he says,) it is evident that as want of time prevents the operative classes from pursuing a systematic course of education in all its details, a more summary and compendious method of instruction must be adopted by them. The majority must be content with never going beyond a certain point, and with reaching that point by the most expeditious route. A few, thus initiated in the truths of science, will no doubt push their attainments much farther; and for these the works in common use will suffice; but for the multitude it will be most essential that works should be prepared adapted to their circumstances.— Thus, in teaching them geometry, it is not necessary to go through the whole steps of that beautiful system, by which the most general and remote truths are connected with the few simple definitions and axioms; enough will be accomplished, if they are made to perceive the nature of geometrical investigation, and learn the leading properties of figure. In like manner, they may be taught the doctrines of mechanics with a much more slender previous knowledge both of geometry and algebra, than the common elementary works on dynamicks pre-suppose in the reader. Hence, a most essential service will be rendered to the cause of knowledge by him who shall devote his time to the composition of elementary treatises on the Mathematics, sufficiently clear, and yet sufficiently compendious, to exemplify the method of reasoning employed in that science, and to impart an accurate knowledge of the most useful fundamental propositions, with their application to practical purposes; and treatises upon Natural Philosophy, which may teach the great principles of physics, and their practical application, to readers who have but a general knowledge of mathematics, or who are even wholly ignorant of the science beyond the common rules of arithmetic. Nor let it be supposed, that the time thus bestowed is given merely to instruct the people in the rudiments of philosophy, though this would of itself be an object sufficiently brilliant to allure the noblest ambition; for what higher achievement did the most sublime philosophy ever aspire after, than to elevate the views and refine the character of the great mass of mankind—at least in later times, when science no longer looks down as of old upon the multitude, supercilious, and deeming that great spirits alone perish not with the body? But if extending the bounds of science itself be the grand aim of all philosophers in all ages, they indirectly, but surely, accomplish this object, who enable thousands to speculate and experiment for one to whom the path of investigation is now open. It is not necessary that all who are taught, or even any large proportion, should go beyond the rudiments; but whoever feels within himself a desire and an aptitude to proceed farther, will press forward; and the chances of discovery, both in the arts and in science itself, will be thus indefinitely multiplied. Indeed, those discoveries immediately connected with experiment and observation, are most likely to be made by men, whose lives being spent in the midst of mechanical operations, are at the same time instructed in the general principles upon which these depend, and trained betimes to habits of speculation. He who shall prepare a treatise simply and concisely unfolding the doctrines of Algebra, Geometry, and Mechanics, and adding examples calculated to strike the imagination, of their connection with other branches of knowledge, and with the arts of common life, may fairly claim a large share in that rich harvest of discovery and invention which must be reaped by the thousands of ingenious and active men, thus enabled to bend their faculties towards objects at once useful and sublime.

"Although much may be done by the exertions of individuals, it is manifest that a great deal more may be effected by the labours of a body, in furthering this important measure. The subject has for some time past been under consideration, and I am not without hopes of seeing formed a Society for promoting the composition, publication, and distribution of cheap and useful works. To qualify persons for becoming efficient members of this association, or co-operating with it all over the country, neither splendid talents, nor profound learning, nor great wealth are required. Though such gifts, in their amplest measure, would not be thrown away upon so important a design, they are by no means indispensable to its success. A well-informed man of good sense, filled with the resolution to obtain for the great body of his fellow-creatures, that high improvement which both their understandings and their morals are by nature fitted to receive, may labour in this good work, either in the central institution, or in some remote district, with the certainty of success, if he have only that blessing of leisure for the sake of which riches are chiefly to be coveted. Such a one, however averse by taste or habit to the turmoil of public affairs, or the more ordinary strifes of the world, may in all quiet and innocence enjoy the noblest gratification of which the most aspiring nature is susceptible; he may influence by his single exertions the character and the fortunes of a whole generation, and thus wield a power to be envied even by vulgar ambition for the extent of its dominion—to be cherished by virtue itself for the unalloyed blessings it bestows."

Although it was only what was to be expected, it is gratifying to perceive that Mr. Brougham so fully appreciates the advantages to be derived from leaving the people the entire management of their own institutions, where institutions are formed for the instruction of mechanics; and that the funds necessary for their support, must, in the main, be derived from their own savings. We cannot avoid quoting his opinions on this subject, and recommending them to the serious perusal of those good intentioned individuals, who seem afraid of trusting the management of such institutions into the hands of those who evidently have the greatest interest in their prosperity and success.

"I have remarked, that in forming these Institutions, it is a fundamental principle to make the expenses be mainly defrayed by the mechanics themselves; it is another principle, in my opinion equally essential, that they should have the principal share in the management. This seems necessary for securing both the success and the independence of the system. Nor is there the least reason to apprehend mismanagement. If benefit societies are, upon the whole, well managed, we may rely upon institutions being still better conducted, where the improvement of the mind being the object, those only will ever take an active part, who are desirous of their own advancement in knowledge, and of the general instructions of the class to which they belong. Indeed there seems no better means of securing the continued attention of the Directors, than placing the direction in the hands of those who are alone interested in the prosperity of the concern. Neither is there any fear that the suggestions of persons in a higher station, and of more ample information, may not be duly attended to. Gratitude for assistance received, and advice offered, together with a conviction that the only motive for interfering is the good of the establishment, will give at least their just weight to the recommendations of patrons; and if it were not always so, far better would it be to see such influence fail entirely, than to run the risk of the apathy which might be occasioned among the men, and the abuse of the Institutions themselves, which might frequently be produced by excluding from the control of their affairs those whose interests are the only object in view. The opinions of patrons are always sure to have influence as long as their object plainly is to promote the good of those for whom the Institution was founded; and as soon as they are actuated by any other views, it is very fit that their influence should cease. There is nearly as little reason to apprehend, that the necessity of discussing, at meetings of the members, the affairs of the Institution, will give rise to a spirit of controversy and a habit of making speeches. Those meetings for private business will of course be held very seldom; and a feeling may always be expected to prevail, that the continuance of the establishment depends upon preserving union, notwithstanding any diversity of opinion in matters of detail, and upon keeping the discussion of rules and regulations subordinate to the attendance upon the lectures, the main object of the establishment. The time when information and advice is most wanted, with other assistance from the wealthy and the well informed, is at the beginning of the undertaking; and at that time the influence of those patrons will necessarily be the most powerful. Much depends upon a right course being taken at first; proper rules laid down; fit subjects selected for lecture; good teachers chosen; and upon all these matters the opinions and wishes of those who chiefly contribute to found the several institutions, must receive great attention. What I have now stated, is not merely that which seems likely to happen by reasoning from the circumstances; it has in fact happened in the instances where the trial has been made on the largest scale. We have never found any inconvenience from this plan during the twelve months that our Mechanics' Institution in London has been established. In Glasgow, there is a much longer experience in its favour; with this addition, that a contrary plan having at one time been pursued there, the men ceased to interest themselves in the lecture; and the Institution declined. The extraordinary success of the new Institution, which now places it at the head of all such establishments, may chiefly be ascribed to its administration being in the hands of the men themselves.

"I have said that the *independence* of these undertakings, as well as their success, is to be considered. I really should be disposed to view any advantage in point of knowledge gained by the body of the people, as somewhat equivocal, or at least as much alloyed with evil, if purchased by the increase of their dependence upon their superiors. They will always be abundantly thankful for the help afforded them in beginning such institutions, and quite ready to receive advice from those who render them assistance. But if the latter keep the management entirely in their own hands, they enforce the appeal to gratitude by something very like control; and they hurt the character of those whom they would serve. For this reason, as well as for promoting more effectually and generally the establishment of these institutions, it is of the last importance that the yearly expense should be reduced to such a sum as can be wholly raised by the students. What they receive in money from their superiors will then be given once for all at the outset; what they receive from time to time in good counsel, and in teaching, either by lectures or publications, shows much real kindness, confers a great benefit, and ensures a grateful return, without bringing into action any of those feelings alike painful and injurious, which arise from the assumption of authority grounded on the mere differences of rank and wealth."

The admirable plan of self-instructing institutions, first commenced at the Glasgow Gas Work, Mr. Brougham has likewise brought into notice in this pamphlet; and we have little doubt that it will come into very general use. Indeed it is impossible to conceive any plan more capable of being generally adopted, and at the same time of being more efficient and useful than this one: and it gives us no little pleasure to be able to say, that the promulgation which the plan has already received by Mr. Bannatyne's excellent letter in our pages, addressed to the masters of public works, is likely to promote its general adoption throughout the whole of this neighbourhood, and that the plan is also spreading into England and Ireland. Persons deputed by the workmen at Mr. Dun's different works, Mr. Duncan's printing office, Mr. Todd's mills, from public works at Pollokshaws, and many other places, have made application at the gas works for copies of their regulations to be used in commencing institutions of the same kind at these several works. A letter has been received from Wigan in Lancashire, requesting a copy of the regulations to be sent there for the information of those commencing an institution in that town on the same principles, to which, however, the mechanics belonging to all the public works in the town are to be admitted. A copy of the regulations, and a list of the books originally forming the library of the gas work, has been sent to Ireland; and we have ourselves received another letter with the same request from Cork.—Heaven grant that this excellent plan may find its way into that unhappy country: how much real good, both moral and political, may it not do? From its extreme cheapness, as well as its efficacy, no plan is equal to it for the education of the working classes, especially in Ireland. We sincerely trust that proprietors of large manufactories, and gentlemen residing in the neighbourhood of country villages, will see the advantages in every point of view, arising to mankind from the scientific instruction and intellectual improvement of the working classes in their employment or in their neighbourhood; and that as the best mode of assisting them in this, they will see the advantage of promoting, as far as in their power, the admirable plan of Self-instructing Mechanics' Institutions. When these shall have become general, as we doubt not they will soon be, Glasgow may well be proud, that as she gave the first example to the world of a professor lecturing to mechanics, so she gave the first example of mechanics meeting for mutual instruction, and for the improvement of one another.

As connected with this, and as being in itself not uninteresting, we have obtained, from one of the workmen at the gas work, a copy of a lecture on the Atmosphere, delivered by him to his fellow-labourers in the work. It is useful, to show something of how this plan is carried on, and thus practically to illustrate the effects which such a mode of instruction is likely to produce.

A LECTURE ON THE ATMOSPHERE.

Delivered at the Glasgow Gas Workmen's Institution, by one of its Members.

The atmosphere is that clear transparent fluid which surrounds the globe of our earth, to an unknown height; and which is carried along with it round the sun, in its annual motion, and which is likewise carried round in its diurnal motion upon its own axis. It is colourless, which has been proved by Sausure by experiments made by him with his Cyanometer, at a variety of different heights above the surface of the earth. This instrument consists of a circular band of paper, divided into fifty-one parts, each of which is painted with a different shade of blue—beginning with the deepest blue mixed with black, to the lightest mixed with white. By this instrument Sausure found, that the colour of the sky always corresponded with a deeper shade of blue, according to the height the observer was placed above the surface of the earth: and he thence concluded, that at a certain height the blue will disappear altogether, and the sky appear black—that is, it will at a certain height reflect no light at all. From these observations, it was perfectly evident that the atmosphere itself is colourless. Its colour becomes lighter in proportion to the vapour mixed with it, and it is evidently the vapour which is mixed with it which colours the atmosphere.

The properties of atmospheric air may be divided into two classes, namely, mechanical and chemical. The mechanical properties are gravitation, expansion, and contraction. It, like all other fluids, presses upon the surface of bodies in all directions; and upon each square inch there is a pressure equal to about fifteen pounds. To illustrate the nature and extent of the pressure of the atmosphere, I will take this small cylindrical receiver, which is about an inch and a half in diameter, with a stop-cock attached to the end of it, and screw it upon the plate of the air-pump. Having done this, let me now exhaust the air from the cylinder, and you will perceive I have taken away the internal pressure. Let us now shut the stop-cock, unscrew the cylinder, and immerse the end of it in this bason of water. You now perceive that when I open the stop-cock, the water rushes in to fill the space which the air previously occupied. This is occasioned by the gravitation or pressure of the atmosphere upon the surface of the water. It is upon this principle that the common lifting pump works; for the valves working in the barrel, exhausts the air, and the water rises into the pump to occupy its place: the valves then retain it after it enters the pump, and by this means a continued stream is obtained.

The other mechanical properties of air is its power of expansion and contraction. It is expanded by heat, and contracted by cold. To prove this, let us take this small bladder, which is not (as you see) above half full of air, and hold it over this charcoal fire in the chaffer. The air, you perceive, immediately begins to expand and fill the bladder; and, if I continued holding it for any length of time, the air would expand so much as soon to burst the bladder. But I shall lay it aside here, and you will then observ e that the air will contract to its former size. The air which is discharged at a chimney-top appears to be a great deal more than what could enter at the door and windows when they are all shut: the reason of this is, the air which enters the room is cold, and by the heat of the fire it is expanded, and occupies, as you saw in the instance of the bladder, a greater space; consequently, the discharge must be more, in appearance, than what enters in. If, again, I take the bladder, which has contracted to its former size, and place it under the receiver of the air-pump, and then exhaust the air from the receiver, by doing so I take away the external pressure of the air from the bladder. The air within it, therefore, immediately begins to expand, and to extend the bladder as when formerly we heated it over the chaffing dish. This shows that the air at the surface of the earth is compressed by the weight of the incumbent atmosphere. It is evident, from this, then, that the higher we go above the surface of the earth the air will be found the lighter. This has been fully proven by those who have ascended to the tops of high mountains, and in balloons; for, by taking a barometer with them, they were enabled to measure the height they went above the surface of the earth. You know that it is by the pressure of the air that the barometer works; for the mercury in the tube is compressed and expanded by the different weights of the column of air which presses upon it. These facts are necessary to be known by every person, but especially by those who begin to try experiments, for they will be ready to form wrong ideas, or in danger of breaking vessels, if they have no knowledge of the expansion and contraction of the atmosphere.

The chemical properties of air are those of supporting combustion and respiration. The nature, or cause of combustion, was not known until Doctor Priestley and Scheele discovered air to be a compound consisting of oxygen and nitrogen; and that oxygen alone was the supporter of combustion, while nitrogen was not. Lavoisier was the first who discovered the nature or cause of combustion. He said that when a combustible body was raised to a high temperature, the oxygen which is in the atmosphere combines with the combustible matter, and light and heat are evolved. I can show you this by a very simple experiment. I hold this candle above the glass of that argand burner, at a certain distance from the flame. The wick, which is combustible matter, will be raised to a high temperature, combustion will immediately commence, and light and heat will be evolved. If, upon the other hand, I place this candle upon the shelf of the pneumatic trough, which is, you see, filled with water, and invert over it this bell glass full of air, the candle will immediately go out, for the quantity of oxygen which is in this small portion of air is soon exhausted, and what remains now is nitrogen, which is no supporter of combustion.

In respiration it is the oxygen which is taken up for the support of the animal economy, which I can likewise easily illustrate to you.—Let us take this jar filled with water and invert it upon the shelf of the trough, and then fill it with air from the lungs. Upon introducing a lighted match into it, you see it immediately goes out, thus showing that the oxygen is gone. Air which has been deprived of its oxygen by combustion, cannot be breathed.—There are many instances of people shutting themselves up in a close room at night, and going to bed, leaving a strong fire burning in the room. The fire soon deprives the air contained in the room of its oxygen, and as no fresh supply can get in, the persons asleep then come to breathe the nitrogen, and by this means are found dead in their beds in the morning.

I have now explained to you, and shown by a set of simple experiments the different properties of the atmosphere; and as our time is now gone, I shall conclude for the present with the hope that I shall yet have an opportunity of enlarging on this subject before you.

LITHOGRAPHY.—(Continued from page 26, Vol. III.)

Having in a former No. given a short history of this art, we shall now proceed to give a

Description of the Materials used in it, and the mode of preparing them.

And, among these, the first thing to be attended to, is

The Stones, and the manner in which they are prepared to receive the Drawings.

The stone most used in England is found at Corsten, near Bath. It is one of the white lias beds, but not so fine in grain, nor so close in texture, as the German stone, and, therefore, far inferior. But it is good for transfers, and does tolerably well for ink drawings or writings. Another stone is also used, found near Stony Stratford; but it is of a brownish grey tint, and too dark in colour to show the effect of the drawing with sufficient clearness. All calcareous stones can be used in lithography; because they will all imbibe grease and moisture, but those are best adapted to it which are very compact, of a fine equal grain, and free from veins, or imbedded fossils or crystals.

The stones first used were obtained from the quarries of Solenhofen, near Pappenheim, in Bavaria, and none have ever been obtained to equal them. In France, stones have been found near Chateauroux, of a similar colour to these, and even harder, and of a finer grain; but full of large spots of a softer nature.

In order to sustain the pressure used in taking impressions, a stone, 12 inches square, must be 1¼ inches thick; and the thickness must increase with the size of the stone. The stones are first sawn to a proper size, and are then ground smooth and level by rubbing two of them, face to face, with water and sand. They must be very carefully examined with a straight edge, to ascertain that they are perfectly level in all directions. This applies only to the side which is afterwards to receive the drawing, as the natural division of the stone is sufficiently true for the back.

When the stones have been thus ground perfectly level, they are well washed, to free them from any of the coarser grains of sand which may have been used in smoothing them; and they are then placed on a board over a trough, and again they are rubbed face to face with sand and water, though the sand now used must be of a much finer texture than the sand previously used. The greatest care must be taken to have the sand sufficiently fine; and, for this purpose, it must be sifted through a small close sieve, as a single grain of sand, of a coarser texture than the rest, will scratch the stone, and these scratches will afterwards all appear in the impressions taken from the stone. When the stones have been rendered sufficiently fine, and their grain sufficiently smooth, they must then be carefully washed, and then wiped dry with a clean soft cloth. This is the plan adopted to prepare the stones for chalk drawings; but, to prepare them for ink drawings or writings, the following method is the best: After the process just described has been gone through, the stones are well washed, to get rid of the sand, and they are then rubbed two together, face to face, with powdered pumice-stone and water. After they are made perfectly smooth, they are again washed and wiped dry, and are then separately polished with a large piece of pumice-stone.

In order to clean the Stones after they have been fully used,

Sand is strewed over the surface, and it is sprinkled with water, and rubbed with another stone, until the writing or drawing upon it has completely disappeared. It must then be washed with aquafortis, diluted in 20 times its bulk of water; and the stone is then prepared for a new drawing or writing by being rubbed with fine sand or pumice-stone, as before. The longer drawings remain on stones, the deeper the ink or the chalk penetrates into their substance, and consequently the more of the stone must be ground away to remove them; this is also more necessary with ink drawings than with chalk ones, because ink penetrates much deeper into the stone than chalk.

The stones being thus prepared, it is necessary now to enter upon the substances which are used for drawing or writing upon them. These are

Lithographic Ink, or Chalk.

A great many different receipts have been given for making lithographic ink, and out of these we shall give the best. Two kinds of ink are necessary—that for writing on the stones, and that for making transfers. The best composition which we have seen for ink for writing is the following:

Composition of Lithographic Ink for Drawing on the Stone.

Two ounces of the tallow of candles; two ounces virgin wax; two ounces shell lac; two ounces common soap, and of lamp black nearly about a twentieth part of the whole. These materials must be prepared in an iron sauce-pan having a cover. The wax and tallow are first put in, and are heated till they take fire: while they are burning, the soap is thrown in, in separate pieces, one at a time, care being taken that one be melted before another is thrown in. When the whole soap has been added, the composition must be allowed to burn until it has lost about a third of its quantity. After this the shell lac is added; and, as soon as it is melted, the flame must be extinguished.

After being allowed to cool, it should now dissolve, (though it will do so but slowly,) by rubbing it in warm water. The lamp black, which must be of the finest quality, is now to be mixed with it, which is done while it is melted over a slow fire, adding small portions of the black at a time, and stirring them well together. When the ink is made, and cold, its fracture should have the appearance of Indian ink, though in its substance it is softer. After being completely melted and mixed with the black, it should be run on a marble slab, and a heavy weight placed above it, in order to press it.

After very careful management, the ink will be sometimes found defective; this, however, must proceed from something being wrong with the ingredients, or the manner of their preparation; but, as it is impossible to prevent imperfections, it will be as well to mention a few of those which most commonly occur, with the remedies to be used to remove them.

Defects of the Ink, and Remedies to be used.

1st. The ink will, at times, be found insoluble. The proper remedy, in this case, is to add more soap, in the same manner it was first added. Although the ingredients are to be melted over a fire, in order to have the additional soap mixed with them, they must not be allowed to take fire, as was the case when the soap was at first added.

2d. It is sometimes too soft, and attaches itself to the fingers. When this happens, it must again be put into the sauce-pan, and burned till it gets to a proper consistence.

3d. We find a defect of almost all inks to be, that, some time after dissolving them in water, they become thick and slimy, and require a continual addition of water before we are enabled to draw with it. This is solely owing to its not being sufficiently burnt; and of course the only remedy is, as in the former case, to burn it more.

4th. If the ink is not compact, but full of bubbles, it has been cast too hot on the marble slab. It must therefore be re-melted, cast again when it is less hot, and a heavier weight must be placed upon it.

5th. On other occasions the ink will be found to have no tenacity, and seem to be composed of scorias. When this is the case, it has been either too much burnt, or contains too much black; in either case, add equal portions of wax and soap, and melt it again over a slow fire.

The only other ink we have mentioned as being necessary in lithographic drawing or printing, is

Ink for making Transfers.

This ink is composed of the very same materials as the ink for writing or drawing; but they must be less burned. It will thus be softer, and it must also be afterwards melted and mixed with a little more wax and thick varnish, such as those we shall mention when we come to speak of the printing ink.

Lithographic Chalk.

Besides the inks, we have already mentioned that chalks are used for drawing. Good lithographic chalk ought to have all the qualities of a good drawing crayon. It should be even in texture, and should carry a good point. The best proportions for its composition are the following: an ounce and a half of common soap; tallow two ounces; virgin wax two and a half ounces; shell lac one ounce. The rest of the process is the same as in making the ink. Less black should be mixed with the chalk than with the ink, its only use being to colour the drawing, that the artist may see the lines he traces. When the whole is well mixed it should be poured into a mould, and very strongly pressed to prevent any bubbles which would make the texture irregular.

Now that we have described the preparation of the stone, and of the inks and chalk necessary for drawing, we must next proceed to notice the

Mode of Drawing.

Previous to drawing or writing, the stone must be well wiped with a clean dry cloth. The ink is rubbed with warm water like Indian ink, and must be used on the *polished* stone, while the chalk which would not hold upon it, must be used on the ground stone. A gradation of tints in drawing with the ink, can easily be attained by merely varying the thickness of the line, and the distance at which they are placed apart; for the line traced by the ink being sound and unbroken throughout, receives the printing all over.

It is thus plain that no advantage can be obtained by diluting the ink for the purpose of varying the tints of the lines; and the great object of the artist ought therefore to be, to have his ink of the proper consistency which will stand best throughout the process of printing. A consistency a little stronger than common writing ink will be sufficient for this purpose.

When the chalk is to be used, the ground stone must be cleaned of all dust, and it is then drawn upon with the chalk in the same manner as crayons are used on paper. It is proper that the strength of the tint which is wished should be given at once, as the surface of the stone is altered by receiving the chalk, and it will not receive new lines equally well; and the strength of the tint will be regulated by the pressure of the hand. Nothing but practice ever gives the necessary command of the material, which undoubtedly does not work quite like the common crayon, there being great difficulty in keeping a good point. There is likewise considerable trouble in obtaining the finer tints sound in the impression; and in order to obtain the lighter tints properly, it will be necessary to put the chalk in a rest, as the metal port-crayon is too heavy to draw them, even although there is no pressure of the hand used. Several pieces of chalk should be prepared to use in succession, as the warmth of the hand softens it. It is useful to cut the chalk to the form of a wedge rather than a point, as it is less likely to bend in that form. Small portions sometimes break off during the drawing, these must be carefully removed with a brush.

(To be continued.)

BARKER'S MILL.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—In page 435, on Barker's Mill, it ought to have been stated that when friction and atmospheric resistance are removed, the velocity will increase indefinitely, notwithstanding the inertia of the machine, as this inertia will only prevent the ratio of the increase of the velocity from being very great, although the velocity would still be continually increasing, and that the velocity would become uniform only when the friction and resistance become equal to the pressure of the water.

The above remarks apply to the machine only when it is supposed to do no work.

A. B.

Dollar, 15th Feb. 1825.

MISCELLANIES.

The Detection of Arsenic as a Poison.—Dr. Robert Christison has performed a most acceptable service to the profession, by publishing, in a late Edinburgh Medical Journal, the result of an elaborate course of experiments, establishing simple and unerring *tests*, by which one quarter of a grain of arsenic dissolved in 8,000 parts of either broth, tea, or coffee, with cream and sugar, porter, port-wine, &c., and taken into the stomach, and there mixed with the animal fluids, may be detected. A stream of sulphurated hydrogen gas thrown up through the suspected matter, previously diluted and prepared according to directions which he gives, and with which, doubtless, every medical man will acquaint himself, is the agent by which this effective separation of the arsenic is performed; the precipitated matter is then dried, black flux added, and as much of the mixture inserted into a glass tube, closed at its lower end, but open at top, about three inches long and one-fourth to one-eighth inch diameter, as will fill it not more than half-an-inch from the closed end, which then is to be heated by the alcohol lamp: when soon the arsenic, if any be present, will be seen lining the upper part of the tube, with a metallic steel-like film, or crust; the characters of which crust are so minutely described, and so evident, that henceforward, it is to be hoped, the difficulties of medical evidence will be removed, guilt more certainly punished, and suspicions removed from the innocent.

Temperature of the Sun, &c.—M. Dulong communicated a letter from M. Pouillet, in which that philosopher announced, that he was occupied with experiments relative to the measure of very elevated temperatures, such as those on the surface of incandescent bodies, or bodies in ignition, of flames, and particularly of the sun. The instrument used by M. Pouillet to obtain these results is founded on the properties of radiant heat, and principally on this datum; that a body, the bulb of a thermometer for instance, perfectly insulated in the midst of a sphere of ice, but so placed as to receive the rays of the sun through a circular aperture of such a form and position, that all the lines forming tangents to the sun and the ball may pass through it, will be heated precisely in the same manner as if it were supposed that a portion of the surface of the sun, or of a body heated to the same temperature, exactly filled the aperture in the ice. M. Pouillet, among other results, states, that the temperature of the sun thus determined is 1400 degrees (2552° Fah.) *Jour. de Pharm.*

Signs of Changes in the Wind.—Having frequently amused myself on fine evenings in summer with a very large paper kite, in order to watch the different currents of wind, I had occasion to notice the following curious fact:—On mounting very high, the kite sometimes got into a different current of air, and the wind usually blew from the same quarter on the earth's surface, before the expiration of 24 hours. Thus changes in the wind seem to take place first in the higher regions of the air, and are propagated downwards. I have confirmed this experiment, and established the fact by the use of small air balloons, but the kite answers the purpose quite as well.—*Phil. Mag.*

Important Invention.—A person of the name of Roberts, who is at present in Bolton, has constructed an apparatus, which will prove useful and valuable in the highest degree. Its object is the safety of life and property, in cases of fire, or where any suffocating or noxious vapour exists. It consists of a hood and mouth-piece, so contrived, as to render the wearer enabled to breathe with perfect ease and safety, in the midst of the densest smoke. In cases of dwelling-houses, warehouses, factories, ships at sea, &c. being on fire, its advantages are incalculable. Roberts exhibited the efficacy of the above extraordinary discovery at the mines of the Earl of Balcarras, a few weeks since, to the complete satisfaction of those who witnessed it. On Wednesday last, at the recommendation of several persons in Bolton and the neighbourhood, of the highest respectability, he invited some of the principal tradesmen and inhabitants of the town, to meet him at Messrs. Crook & Dean's Foundry, Little Bolton; where he demonstrated the infallibility of his apparatus, to the utter astonishment of a very respectable party of gentlemen. In the course of the trial, he went into a stove-room, in which sulphur, hay, &c. were burning at the same time. He was shut in for the space of twenty minutes; and came out at the expiration of that time, perfectly sound and uninjured. Had any one without the apparatus remained in the room longer than a minute, it would have been attended with certain death.—*Bolton Express.*

NOTICES TO CORRESPONDENTS.

A. B., S. S., A Constant Reader, G., J. H. B., have been received.—Messrs. King & Co. Cork, shall hear from us.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

Published every Saturday, by W. R. M'Phun, 155, Trongate, Glasgow, to whom Communications (post paid) must be addressed.

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THE GLASGOW
MECHANICS' MAGAZINE,

CONDUCTED BY

A Committee of Civil Engineers and Practical Mechanics.

> " What cannot art and industry perform,
> When Science plans the progress of their toil ?
> They smile at penury, disease, and storm ;
> And oceans from their mighty mounds recoil."

No. LXIII. *Saturday*, 12*th March*, 1825. Price 3*d*.

LITHOGRAPHIC PRINTING PRESS, &c.

Fig. 1

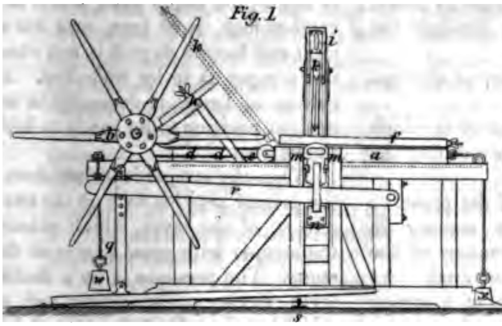


Fig. 2

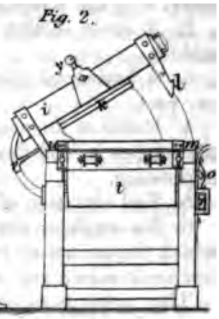


Fig. 3.

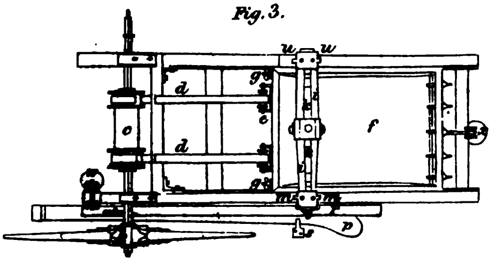


Fig. 4.

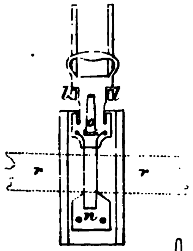


Fig. 7.

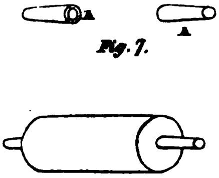


Fig. 6.

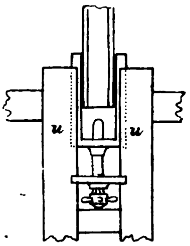
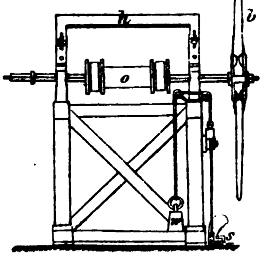


Fig. 5.



— Swan Sc —

LITHOGRAPHY.—(Continued from page 63, Vol. III.)

In our two former articles on this art, we gave a history of it, a description of the stones and inks used in it, and the manner of preparing them: and we now proceed to describe the press and rollers used, with the manner of printing. That given in the engraving is certainly the best we have ever seen, although there are different forms in use.

Fig. 1. Is a side elevation of the press, with the scraper partly down.

2. A cross section through the middle.

3. A horizontal plan of the upper part.

4. Detail of the manner in which the scraper is held down during the impression.

5. End elevation of the press.

6. To explain the manner in which the centre of motion of the scraper is raised and lowered.

The press consists of a strong frame, having on the upper part a platten, or bed, *a*, to receive the stone, and which is moved along grooves in the upper part of the frame by means of a star-wheel, *b*, to the axle of which is fixed a cylinder, *c*. On this cylinder the straps, *d*, *d*, are gathered, which work over the pulleys, *e*, fixed to the bed.

When the stone is placed on the bed, and ready for the impression, the frisket, or cover, *f*, of the bed, is brought down from the position marked by the dotted outline in fig. 1, and shut over the stone, as shown in the same figure. This cover consists of a strong piece of calf's skin, stretched by screws with nuts and hooks, which catch hold of an iron rod sewed along one end of the skin. The other end of it is fixed to the opposite end of the frame. (See fig. 3.) The cover is fixed to the bed by hinges, *g*, which can be screwed at different heights, according to the thickness of the stones. When the cover is opened, it rests against the frame, *h*, which can be adjusted to different heights. (See figs. 1 and 5.)

The cross piece, *i*, having the scraper, *k*, fixed in it, is now brought down, and the catches, *l*, lock into the upper part of the piece, *n*, sliding between the grooved upright, *m*. This is shown more in detail in fig. 4; the upper part, where the catches lock, is of iron, and has a joint and handle to pull it out when the scraper is to be unlocked. A spring, *o*, keeps it generally in an upright position to be ready to hold the catches, *l*, *l*.

When the scraper is locked down, the printer sets his foot on the treadle, *p*, of the lever, which presses the scraper with great power on the stone. The pressure is by a double lever, having a connecting rod, *q*, which can be adjusted so as to bring the upper arm, *r*, nearer to the treadle, when an increase of pressure is required, or a thinner stone is placed on the bed, which makes it necessary to bring the scraper lower down. The arm, *r*, passes through an iron frame on the sliding piece, *n*, and thus brings it down when the treadle is depressed. The hook, *s*, holds down the treadle during the impression.

The star-wheel, *b*, is now turned round, and by this motion the bed is drawn under the scraper, and the impression is taken. The bed passes over a roller, *t*, which is placed with its centre directly under the scraper. See fig. 2.

As the stones are not always of the same thickness, the scraper must be brought to different heights. Fig. 6, shows an adjusting screw for the purpose of regulating the end farthest from the catches, there being a sliding piece between the grooved uprights, *u*, in which the centre is fixed, on which the cross piece, *i*, turns. The iron, *v*, fig. 2, stops the cross piece and scraper from falling back.

When the bed has been drawn out, the printer releases the treadle, which is raised up by the balance weight, *w*, and the scraper being unlocked and thrown back, the bed is drawn to its first position by the weight, *x*.

As the surface of the stone is not always quite parallel to the bed, a simple contrivance has been adopted to allow a self adjustment of the scraper, which is allowed to turn on the centre, and pressed down by a spring acting on each end, but yielding if necessary at either. It is shown by the dotted lines in fig. 2. The screw, *y*, presses the scraper lower, or raises it, if required.

The scrapers are made of beech wood.

The Roller.

The roller for inking the drawing is of the form represented in the Plate, fig. 7. The length may vary, but it ought to be full four inches in diameter. It is covered with flannel, rolled tightly three or four times round, and nailed at the ends. It is then covered with a stretched calf-skin, fitting quite tight. The seam must be made neatly with the boot-maker's closing stitch. The ends of the leather are gathered with a string, and tied round the projecting ends of the roller. Loose handles, A, A, made of thick leather, are put on these ends when it is used. The leather must be put on the roller with the rough side outwards.

Printing Ink.

The printing ink is composed as other printing inks are, of oil, varnish, and very fine lamp-black, well mixed together. To prepare the varnish, a saucepan is about half filled with pure linseed oil, and heated over a fire, till it ignites from the flame of a piece of burning paper. It should then be allowed to burn till it is reduced to the degree required; and if, during the operation, there appears danger of its boiling over, it must be immediately taken off the fire, and the cover, which ought to fit quite close on the saucepan, must be put on to extinguish the flame. This is to prevent accidents; and the operator cannot be sufficiently cautioned against the danger attending the burning of the varnish, which ought never to be performed in a room with a boarded floor, or indeed in any part of a house. Wet sacks are the best things to put out the flame in case of accident.

Several inks must be prepared, differing in the degree of viscidity, or thickness of the varnish from which they are made, and the quantity of black mixed with them. The longer the oil is burned, the thicker the varnish becomes.

The thinnest varnish is burned till it has lost nearly one-fourth of its volume.

The next till it is reduced one-third.

The thickest till it is reduced one-half.

These directions are to be considered as very general ones; and the state of the varnish is best judged of during the burning, by taking out some with a spoon, and letting a drop fall on a cold earthenware plate, and trying its degree of viscidity with the finger. The thinnest sort should be like common honey, the other should draw out in strings, which will be longer as the varnish is thicker. The thickest will draw out in strings two or three feet long.

It is quite essential to have the oil pure, and the saucepan perfectly clean, and to keep the varnish in clean close jars in a cool place.

It is best not to make the varnish long before it is wanted; for if any decomposition takes place in it, the drawing will be spoiled by the printing ink.

The black is mixed with the varnish on a grinding stone with a muller, in small successive quantities; care being taken that the first portion of black is equally mixed with the varnish before a second is added. In the thickest inks this requires considerable labour.

By mixing the varnishes together, any degree of stiffness of the ink may be obtained; and, by putting more or less black, its thickness is regulated.

The printer must always have by him several small pots, each containing a different printing ink, to be used as occasion requires. A small quantity, not more than the size of a hazel-nut, should be used at a time, for it is desirable to charge the roller with as small a quantity as possible. It must be worked well on the colour table with the roller in all directions, that it may be equally distributed all over the roller.

Ink drawings are generally printed with a stiffer ink than chalk drawings.

Preparation of the Stone for Printing.

The drawing being finished on the stone as before described, is sent to the Lithographic printer, on whose knowledge of his art the success of the impressions entirely depends. The first process is to etch the drawing, as it is called. This is done by placing the stone obliquely on one edge over a trough, and pouring over it very dilute nitric acid. It is poured on the upper part of the stone, and runs down *all over the surface.* The stone is then turned, and placed on the opposite edge, and the etching water, being collected from the trough, is again poured over it in the same manner. The degree of strength, which is little more than one *per cent.* of acid, should be such as to produce a very slight effervescence; after the etching water has lain on the stone for a second or two, its strength must vary according to the heat of the atmosphere, and the degree of fineness of the drawing. It is desirable to pass the etching water two or three times over the darkest parts of the drawing, as they require more etching than the lighter tints. Some stones also, and different chalks, require different degrees of strength of the acid, and experience alone can guide the Lithographer in his practice on this point. Chalk drawings require weaker acid than the ink.

The stone is now carefully washed, by pouring clean rain water over it, and afterwards with gum-water; and, when not too wet, the roller, charged with printing-ink, is rolled over it in both directions—sideways, and from top to bottom, till the drawing takes the ink. It is then well covered over with a solution of gum-arabic in water, of about the consistency of oil. This is allowed to dry, and preserves the drawing from any alteration, as the lines cannot spread, in consequence of the pores of the stone being filled with the gum. After the etching, it is desirable to leave the stone for a day, and best not to leave it more than a week, before it is printed from. In some establishments a few proofs are taken immediately after the drawing is etched, but it is better not to do so.

The operation of the etching requires great nicety, and must be done quickly. If the drawing is etched too strongly, the fine tints disappear; if too weak, the printing ink mixes with the darker parts, and the drawing runs into blots. A soft stone requires weaker acid than a hard one, if they are equally pure in quality. The differences in the composition of the stones also require differences in the strength of the etching water, so that no strict rules can be given.

The effect of the etching is, first, to take away the alkali mixed with the drawing chalk or ink, which would make the drawing liable to be affected by the water; and, secondly, to make the stone refuse more decidedly to take any grease. The gum assists in this latter purpose, and is quite essential to the perfect preparation of the surface of the stone.

(*To be continued.*)

ON THE STRENGTH OF CAST-IRON. No. I.

General Observations.

We know no subject in Mechanics more worthy of minute attention, both from the engineer and the artisan, than the subject of the strength of materials; and yet we believe that there is none on which less attention is bestowed. When we consider how much a proper knowledge of this matter is advantageous to the strength and stability, and at the same time the beauty and elegance, not only of all our public works, but of the houses in which we live, and on the safety and convenience of which so much of our comfort depends, we are quite astonished that it has not become a subject of the most particular and undivided attention.

It is unquestionable, that the application of scientific principles have already done much in advancing a knowledge of this branch of mechanics; and the improvements in the construction of dwelling-houses fully illustrate this. Architects now know that strength does not depend on a lavish expenditure of materials, or of workmanship: and we are now as secure as we formerly were, notwithstanding that we have gained in economy and convenience by reducing the thickness of the walls, reducing the breadth, and adding rather to the depth of the joists for flooring. Although, however, something has *been done* still much requires yet to be done to spread the knowledge of the strength of materials, and of the loads which they will with safety bear; for it is truly deplorable to find, and we find it every day, men using articles as supports, or as parts of machinery, without paying the least attention to the strain to which the materials they are using are subjected, or are able to bear. We know that strength does not depend so much upon the mere mass of materials used, as in their skilful disposition, and the due proportion which one part bears to another; but we every day find persons acting as if in entire ignorance of this, and the most distressing accidents occurring from heedlessness and inattention to it. In all Mechanic Institutions, the subject of the strength of materials ought to be a prominent subject in which the students should receive instruction; and its investigation ought to form an important part of the Professor's duty. And this is the more necessary, because the manner in which the subject has been treated by the common mechanical writers, has in itself misled not a few practical men who were anxious to proceed upon sure ground, and has given occasion for the sarcastic remark, "that the stability of a building is inversely proportional to the science of the builder."

The security and economy derived from the use of cast-iron for supporting considerable weights, pressures, or moving forces, has caused it lately to be very much used; and, indeed, it is likely soon almost entirely to supersede the use of wood for many important purposes. Indeed, so considerable are the improvements which have arisen out of its use, that the period of its general introduction has been very justly considered as forming a new era in the history of machines. "All other improvements," it has been remarked, "have been limited, confined to particular machines; but this having increased the strength and durability of every machine, has improved the whole."

Cast-iron is a valuable material, because it gives safety against fire; it is not liable to sudden decay, nor is it soon destroyed by tear and wear; and it can with ease be moulded into the form of greatest strength, or that which is best adapted to our intended purpose.

Every one has foreseen the danger likely to arise from the use of timber for supporting large buildings, in the event of fire, or of decay, and cast-iron has presented a valuable substitute, which they conceived not subject to the same defects. But it has too often unfortunately happened, that where cast-iron has been used for protection against these evils, the structure has failed from want of strength. This, however, has not been from any deficiency in the material itself, but from want of experience and knowledge in the persons conducting the work. Some people imagine that a large piece of iron is possessed of almost infinite strength, and they have likewise an exceedingly indistinct notion of pressure. They fix the dimensions of the most important part of a structure by chance or caprice; and, calculating the value of the materials they are using to the fraction of a penny, they very seldom calculate any thing about the strength of the material, or the pressure to which it is to be subjected.

But not only is it necessary to calculate the resistance of any material to fracture, but it is necessary that we should do something more. For, besides that it is necessary any part of a machine, or a building, should bear a certain stress without breaking, it is likewise necessary that they should maintain a certain form or position. No doubt, where the parts are short and bulky, it may do very well to employ the rules for resistance to fracture, and make the parts strong enough to sustain four times the load, but such cases rarely occur; and, where long pieces are loaded to one-fourth of their strength, we may expect much flexure, vibration, and instability.

If a material of any kind be loaded with more than a certain quantity, it loses the power of recovering its natural form, when the load is removed; the arrangement of its particles undergoes a permanent alteration; and, if it supports the same load during a considerable time, the deflexion will increase, and the more in proportion as the load is above the elastic force of the material.

It has been found, that while the elastic force, or power of restoration, remains perfect, the extension is always directly proportional to the extending force, and that the deflexion does not increase after the load has been on for a few seconds; but, when the strain exceeds the elastic force, the extension or deflexion becomes irregular, and increases with time. This was observed from considering the proportions for cannon, and the common method of proving them. It appeared, from this, that firing a certain number of times with the same quantity of powder, would burst a cannon when the strain is above the elastic force of the material, though the effect of the first charge might not be sensible.

In the moving parts of machines, the strain should obviously be under the elastic force of the material; and every one must feel satisfied that the measure of the resistance of a material to flexure is the only proper measure of its resistance when it is to be applied in the construction of buildings, and that of its resistance to permanent alteration when it is used for machines. The weight of the beam itself should always be estimated, and added to the load which it is to support, otherwise we will always run the risk of over-loading it.

Soft grey cast-iron has justly received the preference over white cast-iron, because it is less liable to fracture by a blow or shock than the other. White cast-iron is less subject to be destroyed by rusting than the grey kind; and it is also less soluble in acids: therefore it may be usefully employed where hardness is necessary, and where its brittleness is not a defect; but it should never be chosen for bearing purposes. In a recent fracture it has a white and radiated appearance, indicating a crystalline structure. It is very hard and brittle. Grey cast-iron has a dull granulated fracture of a grey colour; it is much softer and tougher than the white cast-iron. Between these kinds, however, there are many varieties of cast-iron, having various shades of these qualities; those should be esteemed the best which approach nearest to the grey cast-iron. The best and most certain test of the quality of a piece of cast-iron is to try the edge with a hammer: if the blow of a hammer make a slight impression, denoting some degree of malleability, the iron is of a good quality, provided it be uniform; if fragments fly off, and no sensible indentation be made, the iron will be hard and brittle. Great care should be taken to have cast-iron of the proper quality, because when it fails it gives no warning of its approaching fracture, which is indeed its chief defect when employed to support pressure. The parts of each casting should be kept as nearly the same bulk as possible, in order that they may all cool at the same rate. Air bubbles should be very carefully prevented from getting into the castings; and the more time there can be allowed for cooling the better, because the iron will be tougher than when rapidly cooled; slow cooling answers the same purpose as annealing.

ESSAYS ON WEAVING.

II.—THE HISTORY OF THE COTTON MANUFACTURE, FROM ITS INTRODUCTION INTO EUROPE, UNTIL THE APPLICATION OF MACHINERY TO SPINNING YARN.

We now proceed to give some account of the introduction and the progress of the cotton manufacture in Europe. It is not very clearly known where the manufacture of cotton goods was first attempted in Europe; but it is said that it was in the commercial states of Italy, even before the discovery of the passage to India by the Cape of Good Hope. The wealthy republics of that fertile country had, until that discovery was made, been the medium through which the rest of Europe was supplied with the produce and manufactures of India; and from this it is supposed they had been led to attempt to imitate the articles which formed so important a part of their merchandize, and from the sale of which they derived so large a profit. It is likewise said, that the introduction of this art into Europe was much later than the discovery of the Cape of Good Hope; and that the first attempts in it were made by the people in the low countries, in order to imitate the goods imported by the Dutch from their settlements in the east. But there is every reason to think that this last account of the matter cannot be correct; because Guicciardini, in 1560, in a very full list which he gives of the articles imported into, and exported from, Antwerp, then the greatest commercial mart in Europe, mentions fustians and dimities among the manufactured articles imported from Milan, and cottons generally among those brought from Venice; while in the articles exported from Antwerp, cotton cloths is not once mentioned. Italy, therefore, at that time had a cotton manufacture, which, it is probable, soon after made its way into the Netherlands; because we are well aware that it was brought from thence to this country by Protestant refugees, at the end of the sixteenth and very early in the seventeenth century.

We know that this manufacture was carried on in England very early in the seventeenth century; for, in the Treasure of Traffics, published in 1641, it is said, that "The town of Manchester buys linen yarn from the Irish in great quantity, and, weaving it, returns the same again in linen into Ireland to sell. Neither does her industry rest here; for they buy cotton wool in London, that comes from Cyprus and Smyrna, and work the same into fustians, vermillions, and dimities, which they return to London, where they are sold, and from thence not seldom are sent into such foreign parts, where the first material may be more easily had for that manufacture."

These goods were woven chiefly about Bolton, and were purchased there at the weekly market by the Manchester dealers, who afterwards finished them, and sold them to their customers over the country.

The weaver at this early period, and, indeed, long afterwards, provided his own warp, which was of linen yarn, and the cotton wool for his weft, buying them wherever he could best supply himself. He soon found that this caused a very unprofitable waste of time; and, to remedy this, the Manchester purchasers established agents, who purchased the raw material, and gave it to the weaver in exchange for the manufactured articles.

It is quite impossible to enumerate all the different manufactures which have been successively brought forward since the introduction of this art; but the fustians which were made at this early period, were those denominated herring-bone, pillows for pockets and outside wear, strong cotton ribs and barragon, broad raced linen, thickset and tufts, with whitened diaper, striped dimities, and jeans. At some distance of time there were added to these, cotton thicksets, goods figured in the loom; and at a still later date, cotton velvets, velveteens, and strong and fancy cords. The pattern-cards, however, of the principal houses in the trade, circulated from time to time through these kingdoms, and over the continents of Europe and America, have exhibited specimens of nearly two thousand different kinds, comprehending in the assortment every variety of taste and fancy.

For the introduction and after improvement of many of these articles, the country is indebted to the late John Wilson of Aimsworth.—

This gentleman was originally a manufacturer of fustians at Manchester, and had early engaged in the manufacture of cotton velvets, which, by persevering efforts, he succeeded in bringing to the utmost degree of perfection. His improvement of the mode of dressing and finishing, and particularly of dyeing these goods, acquired to them so great a character both in the home and foreign market, that they always sold in preference to those of every other manufacturer. He cleared off the loose and uneven fibres from them with razors, and then burned or singed them with spirits of wine. Afterwards he made use of hot irons, which had been first used in the manufacture carried on in the Manchester House of Correction. Mr. Wilson, at a subsequent period, cleared the cloth of the loose fibres, by drawing it rapidly over a cast iron cylinder, heated to redness. These several inventions give us some idea of the manner in which improvements are introduced into our manufactures, when fortunately the efforts of self-interest come to be directed by intelligence and talent.

About the year 1760, owing to the cheaper accommodation and the lower rate of men's wages, a considerable share of the calico-printing business was transferred from London to Lancashire; and the diminution in price thence arising, had the effect of producing a greater demand for calicoes, which were then made of linen warp and cotton weft, it having, until the introduction of Sir Richard Arkwright's discovery, been found quite impracticable to spin cotton thread of sufficient strength for warp.

It was at this period that the Manchester dealers first began to introduce the practice of employing the weaver, and giving him the warp and the weft, and a fixed price for weaving them. He now received from the dealer a stated quantity of linen warp, and a proportional quantity of cotton wool, which he had to get spun into weft, and for weaving which he received a fixed price when he returned the web.—So fast, however, was the weaving at this time outstriping the spinning, that the weaver often found himself obliged to pay more than he had been allowed by his employer for this part of the process. Yet he durst not complain, lest his looms should have been left unemployed, by the refusal of the spinner to spin his yarn. Had this state of things continued, the farther progress of the art must have been stopped; but the discovery of a more productive mode of spinning became absolutely necessary.

It has been said, that the yarn produced at this time in England by the one thread wheel, the only spinning machine then known, did not exceed in quantity what 50,000 spindles of our present machinery can yield. To have reared and trained hands sufficient to have doubled this quantity, had it been possible, must have been the work of a length of time, and still the amount of the manufacture would have been insignificant. A change in the system, therefore, had become indispensible, and we find that different ingenious persons had now began to apply themselves to the invention of some mode of spinning more productive than that which had been hitherto adopted.

In Scotland, the cloth manufacture of any kind made little progress until after the Union, for we find that in 1668 the Scots exported linen yarn to England, which they would not have been very likely to do at the time, had the manufacture at that time met with much encouragement. But after the period we have alluded to, it was greatly promoted by the fostering care of the Board of Trustees, which was established by charter in Edinburgh in the year 1727, for protecting and encouraging the Scotch manufactures and fisheries. The greater part of the goods manufactured in Scotland, however, were made of linen yarn, till about 1759, when a branch of the silk trade from Spitalfields, London, was established in Paisley, where it was brought to such perfection, especially in the more light and fanciful kinds, that in a short time Paisley silks not only rivalled those of the south, but had a preference in all the markets in Europe; and thus laid the foundation for that extensive knowledge of fancy weaving for which the tradesmen of Paisley have since become so famous, and which is now spread over the West of Scotland. In our next essay, we shall give the history of the progress and present state of the spinning of cotton by machinery, that invention, which, next to the steam engine, has been of such wonderful advantage to the wealth and prosperity of the country.

ON BRONZING BRASS GOODS.

The first thing to be attended to in this art is the preparation of the bronze to be used. Many receipts have been given for preparing these, but the two following we think decidedly the cheapest and the best we have seen.

Receipt for making Green Bronze.

Take one quart of strong vinegar; half an ounce of mineral green; half an ounce of raw amber; half an ounce of sal amoniac; half an ounce of gum arabic; two ounces of French berries; half an ounce of copperas; and about three ounces of green oats, if these can be procured; although, if they cannot, the preparation will succeed perfectly well without them. Dissolve the different salts and gums in small portions of the vinegar; then mix the whole in a strong earthen vessel, adding the berries and the oats, over a gentle fire: bring the compound to boil. Then allow it to cool, and filter it through a flannel bag, when the bronze will be fit for use.

Receipt for making Bronze commonly used by Brass-founders.

Take one English pint of strong vinegar; one ounce of sal amoniac; half an ounce of alum; a quarter of an ounce of arsenic: dissolve them in the vinegar, and the compound is fit for use. This bronze frequently answers perfectly well when the vinegar and sal amoniac alone are used. We know brass-founders who have been in the habit of using this cheap composition for several years; and, where the metal is good, it is very seldom found to fail.

The bronze being now prepared, the next thing to be attended to is the cleaning of the brass-work, to be bronzed; and the best method for

Cleaning work previous to using Bronze,

Is either by filing, turning, rubbing with sand-paper, or dipping in aquafortis. It is absolutely necessary, in order to be successful, to have the work well cleaned, and free from grease especially; and the latter of these methods is certainly the best, and therefore ought always to be used when it is wished to succeed particularly well, although any of the above methods are perfectly sufficient for ordinary purposes.

Having thus got the bronze and

the work ready, we now proceed to describe the manner

Of Bronzing.

This must be done with a small brush, and great care must be taken to keep the work constantly wet with the liquid, to prevent it turning green. When the colour which is wished has been attained, which will generally be in from twenty to thirty minutes, the work must be quickly washed in clean cold water, and then dried in soft warm sawdust, after which the whole is laid over with a coating of lacker, which preserves the colours.

It often happens, however, from the quality of the brass, that the bronze will not bring the work to a sufficiently dark colour; means must be used to remedy this defect, and we think

The best and cheapest method of giving the proper dark tinge to Bronze,

When, from the nature of the metal, we cannot otherwise succeed, is the following: Mix about a quarter of an ounce of the finest lamp black, with about one gill of strong spirit of wine, and strain the mixture through a fine linen cloth. The work on which the bronze has been already used must then be warmed upon a cistern plate, or over a clear fire, until it can scarcely be held in the hand. Then, with a fine camel hair brush, such as is used for lackering, the work must be laid over with this mixture, in very thin coatings, until the shade required be obtained. When cold, it must be polished with a very soft brush, or piece of linen rag, dipped or moistened with clear green oil. A coating of lacker is then laid over the whole, and the most beautiful bronze will be obtained that can be produced on brass; and, if the work is not made too black with the mixture, nor the lacker used of too bright a yellow, the bronze obtained will be a beautiful dark green—the colour now so much used by the English brass-founders. By this it will be seen that any shade of what is called green bronze can be obtained, simply by using more or less of the blacking, and a lighter or darker colour of the yellow lacker; and the different tints wished to be given to the work will of course be obtained by the different thickness of the coatings of blacking which the several parts of the work receives. The work, however, will stand much longer in colour, when the bronze can be made sufficiently dark without using the blacking at all; and this can be done, although it takes longer time than is required when the blacking is used.

Method of giving the Bronze the proper shade, without using the Blacking.

When either of the bronzes first described have been used, and the work dried, as there described, if the shade should not appear so dark as is wished, let the work be placed before a smart fire, or in bright sunshine, where, however, no current of air passes. When thus exposed, let it be turned occasionally, and brushed with a soft brush. This plan will be found to produce a very fine bronze, after all other means have failed, (with the exception of the blacking,) but it is tedious, and where time is an object it will always be found best to use the blacking.

We are aware that many other receipts for making bronze are to be met with; but those we have given are decidedly the best and cheapest used, and are the best fitted for practical people. In our next we shall give some equally cheap receipts for making lackers, with practical observations on lackering.

ON COPYING MACHINES.

MANY plans have been adopted for obtaining duplicates of writings with ease and expedition; and a short account of a few of the different methods may not be uninteresting. In 1780, a patent was obtained by Mr. Watt for a method invented by him. In his plan, a thin unsized sheet of paper is wetted, and laid between two woollen cloths, that the unnecessary moisture may be absorbed. This paper is laid upon the surface of the paper to be copied, whilst the writing is yet recent, and they are both either passed through a rolling-press, or subjected to the action of a screw-press. When they are removed, the thin paper is found to have received an impression of the letter reversed; but this impression is legible in the right direction when held between the reader and the light. The paper may either be wet with water or with a liquid composed of vinegar, boracic acid, oyster shells, and gall nuts.

A patent was obtained by Mr. W. Bell, for a method of copying letters into a letter-book. A letter-book is made of thin unsized paper, and the leaf of the book on which the impression is wished to be made is wetted; the writing, while yet recent, is, as before, applied to the wetted leaf; the book is then shut and subjected to the action of a screw-press. The writing is transferred to the leaf, and may be read right by being held as before.

Mr. Ralph Wedgewood of Piccadilly, in 1806, obtained a patent for another mode of producing duplicates. In his plan, a sheet of paper is spread over with printers' ink on both sides, and is then allowed to dry, during six weeks, between leaves of blotting paper; a sheet of letter paper is laid on a smooth pewter or copper plate.—The blackened paper is laid above this, and above is a leaf of thin paper, oiled to make it more transparent. On the paper thus arranged, the person writes with a piece of agate, ground and polished to a smooth round point. The letter paper receives an impression from the blackened paper, which is in the right direction, and, consequently, is used as the original. The upper oiled paper receives an inverted impression, which can of course be read correctly by looking through the paper.

A different class of machines are those in which the hand of one writer gives motion to two pens at once, so as to produce two similar writings at the same time. Hawkin's Polygraph is of this nature. It consists of two pens placed in a frame, and connected with joints, so that when any motion is given to one pen, the second pen performs a similar motion; so that whilst a person is employed in writing a letter with one of these pens, the second makes a copy on a different sheet of paper.

Dr. Franklin proposed a mode of copying letters, which consisted in writing the letter with gumed ink, which was sanded over with emery powder. The letter was then placed on a smooth pewter plate, and subjected to the operation of an engraver's printing press, by which an impression of the emery is left on the pewter, and printing ink being applied to the pewter plate, an impression was to be taken, which was to serve as a copy of the letter.

There is a very simple process, however, which we have often tried for obtaining copies of recent writings, and which has been used for that purpose in many of the public offices in England for several years. It is the more useful because it requires neither machine nor preparation; and may be used in any situation. It consists in putting a little sugar in common writing ink, and with this, writing on common paper, sized as usual.—When a copy is required, the unsized paper is taken and lightly moistened with a sponge. This wet paper is then applied to the writing, and a flat iron, such as is used by laundresses, of a moderate heat, being lightly passed over the unsized paper, the impression or copy is immediately produced.

LETTERS AND QUERIES.

ON WATER-TRAPS.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—Notwithstanding all the attention which has been bestowed to the improvement of Water-Traps, &c. at the mouths of Common Sewers, and the reasonable appearance which some of the proposed plans assume, there still seems to be some difficulty about bringing any thing effectual into operation. Permit me to offer one remark on this useful subject. In situations where the common sewers are very disagreeable, I would humbly beg to propose, that, early in the morning, the nearest fire plugs ought to be opened, and allowed to run for a certain period, so as to wash the drain, and thoroughly cleanse it. This could easily be attended to by the Police; and, should it not prove altogether effectual, I am satisfied that it would at least improve what has been complained of, and neither be extravagant nor troublesome.

I am, Gentlemen, yours, &c.

G.

Glasgow, 1st March, 1825.

ON MR. SAUL'S IMPROVED WINDOW.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—In No. LX. Vol. III. of your Magazine, there is a drawing and description of a shop front, with sliding shutters, by Mr. Saul, of Lancaster; and, in the succeeding Number of your Magazine, page 48, your Correspondent J. P. writes, "It is but justice to Messrs. Wm. and Jas. Carswell, Builders in this city, to say that these improved shop-fronts, &c. on Mr. Saul's principle, have been used and put up by them at least twenty-five years ago." Now, whatever may be the merits of the invention, it neither belongs to Mr. Saul, of Lancaster, nor to Messrs. William and James Carswell, of Glasgow; for I have seen a shop front, fitted up exactly on the principle alluded to, with sliding shutters, in Manchester, in the year 1788, by a Mr. Stone, or Stores, (I cannot say particularly which,) master builder there; and, with regard to the supporting of shop fronts with cast-iron, also stated by J. P. as having been introduced by Messrs. Carswell, the merit of that is due to the late Mr. James Burns, Builder in Glasgow.

R. S.

Glasgow, 3d March, 1825.

QUERIES.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—I was not a little surprised, a few days ago, to observe, in a periodical work, an attempt to prove the non-identity of the Rivers Niger and Nile, and giving, at the same time, what appeared to me, some very fanciful opinions upon the sources of the Nile.

If you, or any of your Correspondents, could furnish, from ancient or modern authorities, a solution of this great problem of perplexed speculation, you would much oblige,

Gentlemen, yours, &c.

S. S.

Dumbarton, 23d Feb. 1825.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—Living in rather an exposed situation in the country, I have felt considerable inconvenience, in the winter months, from the rain and storms penetrating through the casements, (particularly at the sill,) and other parts of my windows, and this even taking place after thick coats of paint, white-lead,

&c. had been applied. My house is not of above five years' standing, so that there can be no natural decay, and I am inclined to think that the workmanship originally was as sufficient as any in this country. If any of your ingenious Correspondents, therefore, can point out an effectual preventive against this, they will very much oblige,

GENTLEMEN, yours, &c.

A CONSTANT READER.

Bothwell, 1st March, 1825.

To the Editors of the
GLASGOW MECHANICS' MAGAZINE.

GENTLEMEN,—As I have occasion to put a pile of pumps into a coal-pit, if any of your able Correspondents would set me at rest about this query, they would much oblige,

A. B.

Query.—Suppose a pile of pumps, 25 fathoms deep, with a working barrel ten inches diameter, and the pumps ten inches and a half diameter, which is the common method, would it add any more to the burden of an engine to have the pumps eighteen inches diameter, and the working barrel ten inches, as before mentioned?

A. B.

Near Glasgow, 18th Feb. 1825.

To the Editors of the
GLASGOW MECHANICS' MAGAZINE.

GENTLEMEN,—Would any of your numerous Correspondents inform me what is the cause of the Warping Mill falling back in going to the top, and what is the best mode of removing it?

I am, GENTLEMEN, yours, &c.

A WARPER.

Glasgow, 3d March, 1825.

A Reader of the Glasgow Mechanics' Magazine wishes to know what is the present method of washing fur, so as to clean it? or if there be any better way of cleaning than the present one? Also, the present process used in washing white or yellow doe-skin gloves, so as that they will not shrink, or turn hard after being dry?

USEFUL RECEIPTS.

Cure for the Cancer.—It is said that olive oil, gently boiled for a considerable time in a copper vessel newly tinned, is an effectual cure for cancers. The oil must be brought to the consistency of ointment, and then constantly rubbed on the part affected for two or three weeks or longer.

To prevent Bags from being destroyed by Insects.—It has been found that bags, steeped in a solution of nitre, will effectually keep off the weevil, and other destructive insects, during the longest voyages.

Cheap Polishing Substance.—The following is a cheap and excellent polishing substance: A piece of old hat is immersed for a few minutes in sulphuric acid. The iron with which the hat was originally dyed passes into the state of red oxide—and the old hat then becomes excellent for giving the last polish to even the hardest substances.

Simple mode of obtaining Water.—The following is recommended as a simple and easy method of obtaining water in almost any situation:—The ground is perforated with a borer. In the perforation is placed a wooden pipe, which is driven down with a mallet, after which the boring is continued, that the pipe may be driven still farther down. As the cavity of the borer becomes loaded, it is withdrawn, and emptied, and again inserted. Pipe is added to pipe, so that the boring can be carried to any depth, and water is generally obtained.

To turn Oil into Wax.—By the following process, oil, in an almost rancid state, may be turned into wax. To two parts of oil pour in one of alcohol, and then add another part of nitre, by which the alcohol will be converted into ether. The oil, after turning solid, and standing undisturbed for twelve hours, will be found to be changed into a yellowish white substance, congealed in a single mass, insipid, without smell, and of the nature of wax.

To make an excellent Bleaching Liquid.—Put a small quantity of red lead into muriatic acid, when chlorine is instantly evolved: add water to the mixture, and then any thing inserted into it will have spots or stains, or its colour even instantly removed.

For making a milk white Paint.—Take of skim milk two quarts; fresh slaked lime eight ounces; linseed oil six ounces; white burgundy pitch two ounces; Spanish white three pounds. Let the lime be slockened in water exposed to the air, mixed with about one-fourth of the milk. The oil, in which the pitch is previously dissolved, is then to be added a little at a time; then the remainder of the milk, and afterwards the Spanish white. This quantity, the expense of which is very trifling, is sufficient to give two coats to 27 square yards.

MISCELLANIES.

White Bread.—Dr. Magendie tried the experiment of feeding dogs upon white bread and water, but all the patients died within fifty days, whilst those to whom he had given household bread, (pain de munition,) which only differed from the white bread by retaining a quantity of the bran, continued to thrive very well upon it. It is remarkable, that one of the dogs that died, had been even put upon his usual nourishment between the 40th and 45th days, but nothing could save him from the fatal effects of white bread.

An improved Method of obtaining early Crops of Peas, after severe Winters. By T. A. KNIGHT, Esq. F. R. S. &c.—Considering even trivial improvements to be important relatively to the management of those species of plants upon the culture of which much labour and capital are annually expended, for private use and for the supply of the public markets, I address to the Horticultural Society the following *account of a mode of obtaining an early crop of peas*, which I have practised with great success in the present spring. When severe winters have proved fatal to crops of peas sown the preceding autumn, many gardeners have experienced the advantages of raising other plants in pots, with artificial heat, early in the spring, and subsequently transplanting them into the common soil: and the object of the present communication is only to describe an improvement in the mode of repeating this operation. In the present spring, my garden, owing to its soil being cold, and the climate rather inhospitable, did not contain, in the end of February, a single living pea-plant; and I purposely delayed the experiment, which I proceed to relate, till the first day of March. Upon that day the ground was prepared, and part of the seed sown, as usual, in rows, where the plants were to remain; at the same time other peas, of the same early kind, were sown in circles within the circumference of pots of ten inches in diameter, inside measure. These pots were nearly filled with a compost of a peculiar kind, from the highly nutritive and stimulating qualities of which I anticipated much acceleration in the growth of my plants, with the advantages of being able to remove them, at the proper period, to the open ground, without having their roots at all detached from their pasture, owing to the fibrous organic texture of the compost. This was made of equal parts of thin turf, to which much lifeless herbage was attached, and unfermented horse-dung, without litter; and a quantity of the ashes of burnt weeds, containing, as usual, a good deal of burnt mould, equivalent in bulk to about one-twelfth of the other materials. Equal parts of fresh soil, with unfermented horse-dung, with litter, and a small quantity of quick-lime, or wood ashes, would probably operate as powerfully as the compost above described. The whole was reduced to small fragments, and well intermixed; and the pots were filled with it within an inch of their tops. The peas were then sown upon the surface of the compost, and covered with common mould; and the pots were placed in my peach-house. In this they remained till the plants were an inch high, when they were removed into the open air; but they were protected during the night for some time, and particularly when the character of the evening indicated the probability of frost. In the last week of March the plants were taken from the pots and planted in rows in the open ground; and I have the satisfaction to observe, that very nearly the whole of the compost adhered firmly to their roots; and that their growth subsequently was not apparently checked, in any degree, by their transplantation. They were placed in rows contiguous to those which had been previously sown, a small quantity of compost similar to that put into the pots being added; and the common mould was then closed round their roots, and raised upon each side of the rows. Sticks to support and protect the plants were immediately added, in rather more than the ordinary number and quantity, and subsequently no particular care or attention was paid to them. On the morning of the 29th of April, I ascertained the comparative growth of my plants, which had been subjected to the different modes of treatment above mentioned, in two rows which grew contiguous to each other: when I found the height of those which had been raised in pots to be fifteen inches, and that of the others to be scarcely four inches; and I much doubt whether I ever possessed, in the most favourable season, as forward a crop of peas as my garden now contains. Many causes appear to me to have operated in conjunction to produce the foregoing effects. It has long been known that snow does not, in winter, lie so long upon the ground which has been manured in the same season with fresh unfermented horse-dung, as upon unmanured ground; and, therefore, I conclude that some degree of heat existed in, and emanated from, the compost, though probably never in a sufficient degree to have been sensible to the touch of any warm-blooded animal. If placed in a considerable heap, such a compost as that described, and even when the horse dung is much less in quantity, will heat violently. I have often suffered the compost of this kind, which I employ for pine-apples, to become hot, to prevent the subsequent appearance of earth-worms in it. If heat was in any degree generated by the compost in which the peas grew, the escape of it was necessarily retarded by the numerous sticks by which the ground was partially covered; and little injury could have been sustained from the shade of those, because the quantity of light comparatively with the temperature of the air, and growth of the plants, is very great after the vernal equinox: and it is every day increasing in power and influence.—Another cause of the rapid growth of the transplanted peas has probably been the very favourable state of the soil in which they have been placed, it having been turned over with the spade immediately before transplantation took place: for peas never thrive well in strong soils, when such have been compressed and soddened, in early spring, by much moisture. But the chief causes of their very rapid growth have, I believe, been the highly nutritive and stimulating quality of the compost, and the presence of some degree of additional warmth. For I have, in former seasons, derived great advantage from placing a moderate quantity of nearly similar compost immediately under rows of peas, which have been sown in the usual manner; except that the seeds were placed upon the surface of the soil, within which the compost had been buried, and covered by having the soil collected from each side to form a ridge over them. In all cases where a compost of the kind I have described is employed to accelerate the growth of dwarfish and early peas, it should be used in small quantities only, that the early growth of the plants may be promoted without excessive luxuriance being given.—*Trans. Hortic. Soc.*

Rotherham Mechanics' Institution.—A meeting of the mechanics of Rotherham and its neighbourhood was held at that place on Monday, 28th February, which was very numerously attended, when an institution was established for raising a library, and such models and apparatus as the funds of the society would enable them to purchase; we hope the higher classes will freely give their support to enable the members to carry their laudable design into execution.—*Leeds Mercury.*

NOTICES TO CORRESPONDENTS.

J. A.—A. W.—R. C., Paisley, have been received.—We shall be glad to hear again from " A Weaver."

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

> **"Without Philosophy, we should be little above the animals that dig or erect their habitations, prepare their food in them, take care of their little ones in their dwellings, and have besides the good fortune, which we have not, of being born ready clothed."**

No. LXIV. *Saturday*, 19*th March*, 1825. **Price 3*d.***

PATENT SINGEING APPARATUS, &c.

Fig. 1.

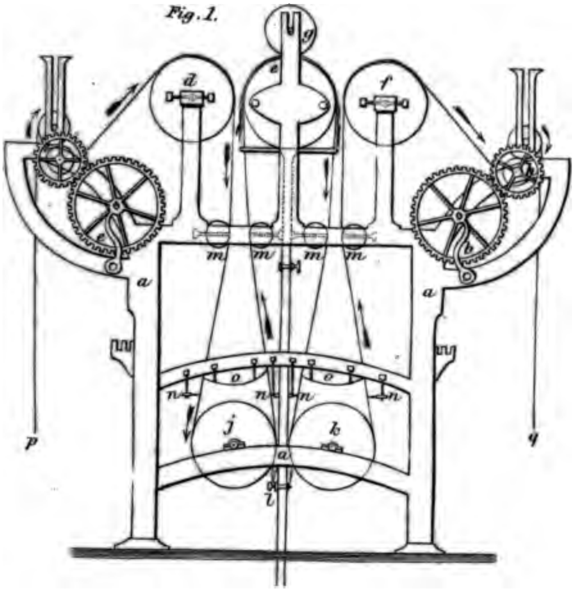


Fig. 2.

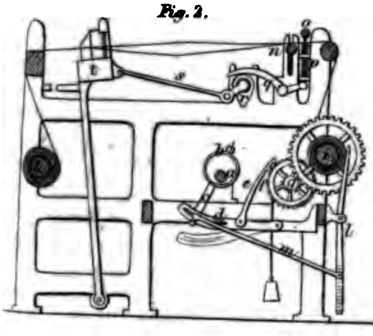
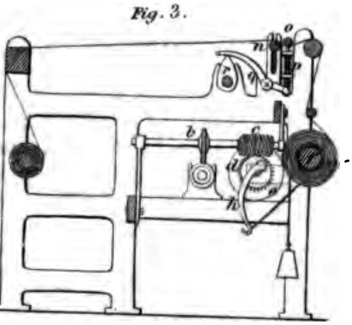


Fig. 3.



— Swan Sc —

Vol. III.

APPARATUS, Invented by Mr. JOHN BURN of Manchester,

For Dressing various kinds of Cotton, Flaxen, Woollen, or Silk Manufactures; and for which he obtained a Patent, Sealed 14th April, 1824.

The purpose of this new invented apparatus is to singe the surfaces of cloths or other fabrics made of cotton, flax, wool, or silk, in order to remove the superfluous fibres of thread, which give a downy appearance to the fabric before it has been dressed by singeing. Red-hot cylinders have been generally employed for this purpose, over which the articles have been passed rapidly, and by that means the fibres burnt off without injury to the threads. The flame of oil-lamps, spirit-lamps, and gas-burners, have also been employed, but these flames have generally been permitted to pass through the interstices of the woven material, and thereby to burn the internal fibres as well as those on the surface, and which has tended considerably to weaken and injure the substance of the fabric.

The present patentee intends to employ a burner, or lamp of gas, oil, or spirit, as he may find most desirable; but it is for the construction of his machinery that the patent is obtained, and not for the material used to produce the flame, by which machinery he purposes to singe both the surfaces of the fabric operated upon, without permitting the flame to pass through its interstices.

Fig. 1, in the plate, represents an elevation of the end of the apparatus; both ends being alike, the width is to be regulated by the breadth of the goods requiring to be dressed; this machine is adapted to a gas-flame, but any other fire, or an ordinary heated cylinder, would answer the same purpose, the gas apparatus not being claimed as part of the invention; *a*, *a*, *a*, is the frame-work of the machine, made of cast-iron, the arrows representing the direction of the cloth, when the handle *b* is turned; for the arrangements of cog-wheels are the same on both sides of the machine, so that the cloth having been wound to one side by the handle *b*, is returned to the other by the handle *c* undergoing a double operation of traversing; *d*, *e*, *f*, are three large hollow cylinders of rolled iron, tinned, all of which revolve on their axis; the bearings of *e* being stationary, and of *d* and *f* moveable, for the purpose of being adjusted by means of screws, which enables them to be moved nearer to or farther from *e*, as the substance of the goods to be dressed, or the dimensions of the fire apparatus may require; *g* is termed a safety-roller, and is formed of wood resting upon, and revolving with, the centre cylinder *e*; it is used as an extinguisher to put out the sparks left by the burning on the surface of the goods.

The roller marked *h*, is the drawing-off roller, having above it another safety roller to extinguish the sparks; the roller marked *i*, with the one above it, on the other side of the machine, is for the same purposes. There are also two other cylinders, *j* and *k*, in the lower part of the machine, under which the fabric passes, as shown by the lines and arrows; and at *l*, *l*, *l*, are three jets of flame, the upper ones acting against the face of the fabric, and the lower one against its back surface, for the purpose of singeing it.

These rollers are all intended to prevent the penetration of the fire beyond the surface of the goods, and by their arrangement the surface to be dressed is presented to the action of the fire in a perpendicular position, so that both sides of the goods are singed at the same time. The rollers *m, m,* fitted with adjustment screws, serve the double purpose of guide and safety-rollers; and there are scrapers *n, n, n,* which advance or recede by means of adjusting screws; *o, o,* are plates of rolled iron, tinned, which are suspended between the doubles of the cloth by adjusting rods, screws, and nuts; these require occasionally to be cleared from the burnt particles which collect on them, the edges of which scrape up the nap of the goods, prepare them for singeing, and remove the burnt particles when done.

Having explained the various parts of this machinery, the patentee proceeds to show its operation, which is as follows:—The fabric to be acted upon is first coiled upon a roller situated near the point *p,* from whence it is conducted between the rollers *i,* which in this case act as tightning rollers; from thence it passes over *d,* under *j,* in the lower part of the machine, then up over *e,* down again under *k,* and up over *f,* to the drawing-off rollers *h,* between which it is conducted to the taking-up roller situated near the point *q.*

In this progress of the fabric it is subjected to the action of the flame at the jets, *l, l, l,* both on the front and back surfaces; and if once passing it through the machine is not found to be sufficient, the handle *c* will conduct it back again, and subject it to a second singeing, in an upright position, which may be continued until the operator shall think the effect complete.

In passing over the cylinder *e,* the cloth also passes under the safety roller *g,* which puts out the sparks almost as soon as created; and the scrapers *n,* not only scrape up the nap, but also take off the particles burnt previously.

It is unnecessary to describe particularly the process of singeing the backside of the fabric, as it is performed in the like manner, but not with such great perfection, as that is not always required.

IMPROVEMENTS IN THE CONSTRUCTION OF POWER-LOOMS FOR WEAVING, AND IN THE MACHINERY AND IMPLEMENTS FOR, AND METHODS OF WORKING THE SAME; AND FOR WHICH A PATENT HAD BEEN GRANTED TO

Mr. Stansfield of Leeds, Mr. Briggs of Lerdenfoot, Mr. Richard of Leeds, and Mr. Barraclough of Barley.

The subjects of this patent are embraced under three heads, the two first of which are different modes of giving out or deliverng the warp from the warp-roller or beam of a power-loom; and the third is a method of increasing and diminishing the tension of the warp at intervals for the purpose of assisting the operation of weaving. Fig. 2, is an end view of a power-loom, with the appendages proposed under the first improvement; *a,* is the main shaft or axle of the loom turned by a band and rigger, or by gear, connected as usual with a steam-engine, water-wheel, or other first mover; upon this shaft is fixed an eccentric wheel *b,* which is embraced by a ring, and to this ring an arm *c,* is fastened for the purpose of moving the lever *d,* up and down in the arc shown by dotts, as the eccentric wheel revolves. To the lever *d*, a pall *e* is jointed, which takes into the teeth of a ratchet wheel *f*, and by the descent of the lever the pall *e* is made to draw the ratchet-wheel *f* round a small portion of a revolution, but in the ascent of the lever the pall slides over the teeth, and thus by the continuous rotation of the main shaft *a*, and eccentric wheel *b*, the lever *d* is kept vibrating, and the ratchet-wheel is carried round by the successive strokes of the pall. Upon the axle of the ratchet-wheel there is a pinion *g*, that takes into a toothed-wheel *h*, affixed to the end, or to the axle of the beam or warp-roller *i*, and thus by the rotation of the ratchet-wheel, the warp-roller or beam *i*, is made to turn very slowly, and to give out as much length of warp as may be necessary to supply the draft of the work-roller *k*.

As the operation of weaving proceeds, the warp will be gradually drawn off, and reduce the diameter of the beam or warp-roller, consequently the delivery of the warp would not be uniform without some mode of compensation; this is effected by means of a vertical lever *l*, the upper end of which has a broad surface pressing against the periphery of the warp-roller, in which situation it is held by a cord with a weight suspended, and the lower end of the lever is connected by a rod *m*, to the arm *c*, extending from the ring that embraces the eccentric wheel. This rod *m* is attached to the lever *l* by a pin, forming a joint, and to the arm *c*, by a bolt passed through a long curved slot in the lever *d*. Now, as the diameter of the warp wound upon the roller diminishes, the upper end of the lever *l*, approaches nearer towards the roller, and the lower end of the lever receding, draws the arm *c* by the bolt at the end of the rod, along the slot, into a perpendicular position, thus increasing the arc in which the lever *d* moves, and causes the pall to take up a greater number of the teeth of the ratchet-wheel at every stroke, and consequently to give an increased velocity to the rotation of the beam *i*, and deliver the warp more rapidly.

The second improvement is another contrivance for the same purpose, viz. the delivery of the warp in a power-loom. Fig. 3, represents the end of a power-loom, in which *a* is the main shaft, actuated, as before said, by a band and rigger, or gear from any first mover. Upon this shaft is an endless screw that takes into a wheel *b*, having oblique teeth; on the axle of this wheel is another endless screw *c*, taking into a similar wheel *d*, attached to the end of a friction-cylinder *e*. The pivots of this friction-cylinder are supported by brackets at each end of the machine (shown by dots) and hang loosely in long holes or slots formed in those brackets; *f* is the roller or beam upon which the warp is wound, and at its extremity a wheel or pulley *g* is affixed. A bent lever or arm *h*, having its fulcrum in the bracket above described, presses against the axle of the friction-cylinder, and by means of a cord attached to the end of this lever, and passed round the wheel *g*, with a weight suspended, the friction-cylinder is brought up in contact with the warp-roller, or beam.

It will hence be perceived, that by the revolution of the main shaft *a*, the endless screw *c* is actuated, which, taking into the wheel *d*, gives a rotatory movement to the friction-cylinder *e*, and by the friction-cylinder pressing against the periphery of the warp-roller, the latter is made to turn in a contrary direction, and to give out the warp in the same proportion that the woven fabric is gathered upon the work-beam. By the pivots of the friction-cylinder turning in slots in the brackets, it is enabled to approach or recede according to the varying diameter of the warp on the roller *f;* and the endless screw *c* is made sufficiently long to take into the teeth of the wheel *d*, whether at its greatest or least distance from the warp roller.

The third improvement is a mode of varying the tension of the warp threads, by which it is intended to relax them when the sheds are opening, and to draw them tight when the batten advances to beat up the weft. In figs. 2 and 3, this apparatus is shown in different positions; *n*, and *o*, are two small rollers or rods extending across the back of the loom; the roller *n*, is pressed upwards against the warp threads by a small wire spring; the roller *o*, stands above the warp threads, its pivots being supported by two vertical rods *p*, which are attached to the ends of levers *q*. The longer arm of the lever *q*, lies upon the periphery of an eccentric cam or heart-wheel *r;* and this heart-wheel is turned round by an arm *s*, connected to a crank on its axle, and to the batten *t;* hence, by the vibrations of the batten, the heart-wheel is actuated, or it may be put in motion by any other convenient attachment to the working parts of the loom.

When the highest point of the cam or heart-wheel is acting against the longer arm of the lever *q*, the roller *o* will be drawn down as in fig. 3, and the warp threads drawn tight; but when the lowest point of the cam is acting against the lever as in fig. 2, then the roller *o* will be raised, and the warp-threads relaxed, which is the case when the sheds are passing each other.

◆

ESSAYS ON WEAVING.

No. III.—HISTORY OF SPINNING BY MACHINERY.

From the earliest ages until the latter end of the eighteenth century, almost no improvements had been made on spinning. The spindle and distaff, although they were still used, had no doubt been changed for the one-thread wheel, but this, in a manufacturing point of view, was but a very trifling improvement over the other. Towards the close of the last century, however, the absolute necessity of making some improvements on this art, led several men of genius to direct their attention to it; and the consequence has been, that a series of the most splendid inventions have burst upon the world, and a great fund of wealth has been created to the British nation. Previous to the year 1767, many unsuccessful attempts had been made to improve the mode of spinning; but at that time James Hargreaves invented his spinning jenny. It is said that this ingenious man first received the idea of his invention from seeing a spinning wheel which had been overturned, continue its motion while lying on its side; and if this really was the case, it shows a mind of no common power, which, from so trivial a circumstance, could bring out an invention of so much importance.

After several unsuccessful attempts to carry into practice the conception he had formed, he succeeded in constructing a jenny of eight spindles, which was turned by bands from a horizontal wheel.—The structure of this machine was afterwards greatly improved, and it was at last brought to work with eighty spindles instead of eight.—Notwithstanding that this machine, when compared with the great improvements which afterwards took place, was rather rude in its construction, yet it must be considered as the first step in that series of inventions which have made so great an alteration in the state of manufactures in this country, substituting the power of machinery for the labour of man, and tending so much to increase the production of capital. As was to be expected, the people who had hitherto earned their subsistence by hand spinning, conceived that this machine would cause their ruin, they therefore mobbed Hargreaves' house, broke into it, and destroyed his machine; and afterwards, when experience had shown to others the value and importance of this new mode of spinning, the people again rose, scoured the country, and broke and destroyed every spinning machine and jenny they could find. Hargreaves had by this time, however, removed to Nottingham, where he was engaged in erecting a small spinning work, and where, in a few years afterwards, he died in great poverty.

Whilst Hargreaves was engaged in producing the spinning jenny, Mr. Arkwright, afterwards Sir Richard Arkwright, was employed in contriving that wonderful piece of mechanism, the spinning frame; by which the whole process of spinning is done by the machinery, leaving to the man only the office of supplying the material, or piecing the thread when it breaks. Mr. Arkwright, living in a manufacturing district, had his attention, it is probable, directed to what was going on around him; and hearing from every one complaints of the deficient supply of cotton yarn, it is probable that his attention was called to the subject, and he set about contriving some better mode of supplying the demand. Totally devoid of mechanical skill or practical experience, even after he had pretty well matured his plans in his own mind, he found great difficulty in being able to execute them; and afterwards his inventions were nearly lost to the world from his inability to get any one possessed of sufficient capital to engage with him in the speculation.

He, like Hargreaves, suffered under the effects of the popular odium their inventions had created against them, was driven from the part of the country where he had hitherto resided, and went and settled in Nottingham about the same time that Hargreaves settled there. Here he prevailed upon Messrs. Wrights, bankers, to advance the necessary money for going on with his inventions, it being understood that if his speculations were successful, they should be entitled to a share of the profits.—These gentlemen, however, finding the advances they were making to be more than they had originally conceived, and perceiving little prospect of remuneration, hinted to him that as such speculations were entirely out of the way of their business, they would be glad he could get some one else to pay them up their advances and take their place in the adventure; and they mentioned to him Mr. Need of Nottingham, as a person likely to do this, from his being already engaged in other patent discoveries, and versant in such undertakings. Mr. Need upon being applied to, and being convinced of the value of the invention, at once acceeded to the proposal; and Mr. Arkwright having, in 1769, obtained his patent for spinning with rollers, Mr. Need, and Mr. Strutt of Derby, a person of great mechanical skill, became his partners. Their first mill was erected in Nottingham, and motion was obtained by horse power; but this being found expensive, a mill was erected at Cromford in Derbyshire, to which motion was given by water.

A short time after his removal to Cromford, Mr. Arkwright began to follow up his first great discovery with other inventions and combinations of machinery for preparing the cotton for spinning, by which perfection was gradually given to the process through all its branches.—In Mr. Arkwright's process of spinning, the cotton wool, after being picked, is carried to the carding engine, which consists of large cylinders covered with cards, with teeth like those of hand cards, which revolve in opposite directions, and nearly in contact with each other. These cylinders were surmounted by other smaller ones covered in the same manner, by whose revolutions in contrary directions to those of the larger ones, and with different velocities, the cotton was carded, and put on the last or finishing cylinder. This, however, is not the method now generally practised. The cotton was taken off the finishing cylinder by means of a plate of metal toothed at the edge like a comb, which, in place of being made to revolve, was moved rapidly in a perpendicular direction by means of a crank, and with slight but reiterated strokes on the teeth of the cards, detached the cotton from them in a uniform fleece. The next step in the process was what is called drawing the cotton. The machine employed for this purpose is what is called the drawing frame, and was constructed upon the same principle as the spinning frame, from which machine the idea of it was taken.—To imitate the operation performed by the finger and thumb in hand spinning, two pairs of rollers are employed; the first pair, slowly revolving in contact with each other, are placed at a little distance from the second pair, which revolve with greater velocity. The lower roller of each pair is furrowed or fluted longitudinally, and the upper one is neatly covered with leather, to give the two a proper hold of the cotton. A carding, when passed between the first of the rollers, will be drawn forward, as they move, without any change in its form or texture, farther than a slight compression received from the incumbent roller. But if from the first pair it be passed through the second, moving with twice or thrice the velocity of the first, it will be drawn twice or thrice smaller than it was when it entered the first rollers. Afterwards, two or three or more of these drawings are passed together through the rollers in the same manner, coalescing as they pass, and forming a single new drawing. This doubling and drawing is several times repeated, having the effect to arrange all the fibres of the cotton longitudinally, in a uniform and parallel direction, and to do away all inequalities of thickness. In these operations the cotton receives no twist.

Roving, which is the next part of the process of preparation, is an operation similar to that employed for drawing the cotton; only that, to give the rove in its now reduced thickness such a degree of tenacity as will make it hold together, a slight twist is given to it, converting it into a soft and loose thread. This is effected by passing it as it leaves the rollers, into a round conical can, which, while receiving it, revolves with considerable velocity. After this the rove is wound by the hand upon a bobbin, by the younger children of the mill, and carried to the spinning frame. A change in this process, however, has been lately introduced into some mills, which is expected to become general. In place of the rove being received in a roving can, as we have described, it is now received upon a bobbin by means of a spindle and fly. The spindle moving with a uniform speed, communicates an equal twine to the rove, while the bobbin, turned by a band which moves upon a cone, has its speed varied, so as to take up the rove equally in all the different stages of the filling of the bobbin. This process saves the expense and trouble of winding the rove by hand, and, it is thought, occasions less waste than the other. But from the greater number and complexity of the movements of this machine, its parts require to be very perfect, and to be kept in the highest order.

The spinning frame has the double set of rollers which have been described in the account given of the drawing and roving frames, and which, operating in the same manner as in those machines, extend the rove and reduce it to a thread of the required fineness.—The twist is given to this thread by the application of the spindle and fly of the common flax wheel, adopted into the machine for this purpose. The yarn produced by this mode of spinning is called water twist, from the circumstance of the machinery from which it is maintained having, for a long time after its invention, been generally put in motion by water.

The only improvement, or even alteration, yet made on Mr. Arkwright's spinning frame, is to be found in the machine called the throstle, introduced some years ago; the spinning apparatus employed in which, however, is in every respect the same as that in Mr. Arkwright's frame, though the movements of the parts are different.

In the year 1775, Mr. Samuel Crompton of Bolton completed his invention of the "mule *jenny*," in the contriving of which he had been engaged for several years. But this machine did not come into general use until after the expiration of Mr. Arkwright's patent, because, till then, the spinner was confined to the rove prepared for common *jenny* spinning, which was so unsuitable for the "mule *jenny*," that it was apprehended this invention would prove abortive. The powers of this machine, however, afterwards came to be known; and its introduction forms another important era in the history of the cotton manufacture. For, being fitted to supply those "grists" and qualities of yarn which the other machines could not produce, the manufacturer was enabled to enter upon fabrics which otherwise it would have been vain to attempt. Warps of the finest quality are spun upon the mule jenny, while on the spinning frame, yarn finer than what is called 50, cannot be spun to advantage.—The mule in its structure and operation, is a compound of the spinning frame and of Hargreaves' spining jenny. It contains a system of rollers like that belonging to the twist frame; but in place of having every four or six of them in separate heads, the whole are coupled together, and the rove being drawn through them, is, in its conversion into thread, received on spindles revolving like those of the jenny. The carriage on which these spindles are placed is moveable, and is made to recede from the rollers a degree faster than the thread is given out. After a certain quantity of the roving has been thus delivered by the rollers, they are stopped, but the carriage continues to recede somewhat farther, and the spindles continuing also to revolve, the thread is drawn out to the fineness required, and then receives its proper portion of twist. This last operation resembles that performed by the common jenny, and produces a similar effect.

The mule was originally worked by the spinner's hand; but in the year 1792, Mr. William Kelly of Glasgow, at that time manager of the Lanark Mills, obtained a patent for moving it by machinery. But he soon saw that, in the extended state of the cotton trade, the exclusive possession of this important improvement was not likely to be quietly acquiesced in, and unwilling to involve himself in the litigation which would have been necessary to defend his privilege, although the undisputed inventor of the process, he allowed every one freely to avail himself of its advantages.

A great object expected to be attained by this improvement in the mule was, that in place of employing men as spinners, children would be able to perform every office required. To give the means of accomplishing this, Mr. Kelly's machinery was contrived so as to move every part of the mule, even to the returning of the carriage into its place, after the draught was finished. It was afterwards found, however, that a greater amount of produce might be obtained, and at a cheaper rate, by taking back the men as spinners, and employing them to return the carriages as formerly, while the machine performed the other operations. It was next found that it was no longer necessary to confine the mule to 144 spindles, the largest number it had hitherto contained, for with the assistance of mechanical movement, the spinner was able to manage two mules of three or four hundred spindles each, and thus to spin on six or eight hundred spindles, while before he had spun on only 144. The process of mule spinning continued to be conducted upon this plan till very lately, when several proprietors of large cotton works have restored the part of Mr. Kelly's machinery, which returns the carriage into its place, after the draught is completed, with the view of relieving the spinner from this operation, and, by lessening the fatigue, of being enabled to employ women in place of men.

In addition to the process for preparing the cotton for frame-spinning, which we have already described, it goes through a farther operation when it is to be spun upon the mule—that of stretching.—When fine yarn came to be spun upon the mule, it was found that extending the roves at once to a fine thread, was a reduction of texture too rapid to admit of the production of a good article, and that an intermediate operation was necessary. This gave rise to the process of stretching, which is performed on a mule fitted up for the purpose, which draws the rove another degree finer, without communicating to it such additional twist as might prevent its being extended afterwards into a thread upon the spinning mule. This process of stretching by the mule has been found so much easier and more expeditious than roving by the spinning frame, that it is now employed in preparing for the coarser spinning, and supersedes the frequent repetition of the drawing process.

LITHOGRAPHY.—(Continued from page 69, Vol. III.)

Printing.

When the intention is to print from the stone, it is placed upon the platten or bed of the press, and a proper sized scraper for the printing is adjusted to the surface of the stone. Rain water is then sprinkled over the gum on the stone, which being dissolved gradually, and a wet sponge passed lightly over it all, the printer works the ink, which is on the colour-table placed beside him, with the roller in all directions, until it is equally and thinly spread all over the roller. The roller is then passed over the whole stone, care being taken that the whole drawing receives a due portion of the ink, and this must be done by giving the roller an equal motion and pressure, which will of course require to be increased, if it is perceived that the drawing does not receive the ink readily.

When the drawing is first used, it will not receive the ink so readily as it will afterwards do; and it is frequently necessary to wet the stone, and roll it several times before it will take the ink easily. When the drawing once takes the ink readily, care must be taken not to wet the stone too much. Indeed, the less dampness now the better, provided there is sufficient to prevent the stone from taking the ink where there is no drawing.

After the drawing is thus rolled in, the sheet of paper is placed on the stone, and the impression taken in the manner described in the account of the press. When, after the impression, the paper is taken up, the stone appears dry, the moisture having been imbibed by the paper. It must, therefore, again be wetted with a sponge, and again rolled in with ink, the roller having been well worked on the colour-table before being applied.

During the printing, some gum must always remain on the stone, although it will not be visible, otherwise the ink will be received on the stone, as well as on the drawing, and the drawing spoiled. So that if by too much wetting, or by rubbing too hard with the sponge, the gum is entirely removed, some fresh gum-water must be laid on. If the stone has in the first instance been laid by with too small a quantity of gum, and the ink stains the stone on being first applied to it, gum-water must be used to damp the stone instead of pure water.—Sometimes, however, this may arise from the printing ink being too thin, as will afterwards appear. If some spots on the stone take the printing ink, notwithstanding the above precautions, some strong acid must be applied to them with a brush, and after this is washed off, a little gum-water is dropped on the place. A steel point is here frequently necessary to take off the spots of ink.

The edges of the stone are very apt to soil, and generally require to be washed with an old sponge or rag after the rolling in. They must also frequently have an application of acid and gum, and sometimes must be rubbed with pumice stone.

If an ink is too thin, and formed of a varnish not sufficiently burned, it will soil the stone, notwithstanding the proper precautions are taken of wetting the stone, and preparing it properly with acid and gum; and if on the other hand the ink is too thick, it will tear the lighter tints of the chalk from the stone, and thus destroy the drawing.

The consideration of these circumstances leads at once to the

Principles of the Printing.

These accidents arise at the extreme points of the scale at which the printing inks can be used, for it is evident, that the only inks which can be employed are those which are between these points; that is, thicker than that which soils the stone, and at the same time thinner than that which takes up the drawing. Lithographers are sometimes unable to print in very hot weather, the reason of which may be deduced from the above. Any increase of temperature will diminish the consistency of the printing ink; the stone will therefore soil with an ink which could be safely used at a lower temperature; hence a stiffer ink must be used. Now, if the temperature should increase so much that the stone will soil with any ink at all less thick than that which will take up the drawing, it is evident that the printing must cease till a cooler temperature can be obtained; for as the drawing chalk is affected equally with the printing ink, the same ink will tear up the drawing at the different degrees of temperature. This, though it sometimes occurs, is a rare case; but it shows that it is desirable to draw with a chalk or ink of less fatness in summer than in winter; and also, that if the printing room is in winter artificially heated, pains should be taken to regulate the heat as equally as possible.

Other difficulties in Printing, not referable to the above general principle.

If the pressure of the scraper is too weak, the ink will not be given off to the paper in the impression, although the drawing has been properly charged with it. Defects will also appear from the scraper being notched, or not correctly adjusted, or from any unevenness in the leather or paper.

After printing a considerable number of impressions, it sometimes happens that the drawing takes the ink in dark spots in different parts. This arises from the printing ink becoming to strongly united with the chalk or ink of the drawing, and if the printing is continued the drawing will be spoiled. The reason of this is easily ascertained. The printing ink readily unites with the drawing, and being of a thinner consistency, it will, by repeated applications, accumulate on the lines of the drawing, soften them and make them spread. In this case it is necessary to stop the printing, and let the stône rest for a day or two, for the drawing to recover its proper degree of hardness. If the drawing should run smutty from any of the causes before enumerated, the following

Mixture for cleaning the Drawing while Printing

must be used. Take equal parts of water, spirits of turpentine, and oil of olives, and shake them well together in a glass vial, until the mixture froths, wet the stone, and throw this froth upon it, and rub it gently with a soft sponge. The printing ink will be dissolved, and the whole drawing also will disappear, though on a close examination, it can be distinguished in faint white lines. On rolling in again with printing ink, the drawing will gradually reappear as clear as at first.

Bleached Paper unfit for Lithographic Printing.

Accidents sometimes occur in the printing, from the qualities of the paper. If the paper has been made from rags which have been bleached with oxymuriatic acid, the drawing will be incurably spoiled after thirty impressions. Chinese paper has sometimes a strong taste of alum; this is so fatal as sometimes to spoil the drawing after the first impression. When the stone is to be laid by after printing, in order that it may be used again at a future period, the drawing must be rolled in with a

Preserving Ink,

as the printing inks would, when dry, become so hard, that the drawing would not take fresh printing ink freely. The following is the composition of the preserving ink:—Two parts of thick varnish of linseed oil, four parts of tallow, one part of Venetian turpentine, and one part of wax. These must be melted together, then four parts of lamp black, very carefully and gradually mixed with it, and it must be preserved for use in a close tin box.

Very good effects are produced in lithographic prints, by

Printing from two or more stones

with different coloured inks. This is managed by preparing a composition of two parts of wax, one of soap and a little vermillion. Melt them in a sauce pan, and cast them into sticks. This must be rubbed up with a little water, to the thickness of cream, and applied to the surface of a polished stone. An impression is taken in the common way from a drawing, and applied to a stone, prepared in this manner, and passed through the press, taking care to mark, by means of this impression, two points in the margin corresponding on each of the stones. The artist having thus on the second stone, an impression from the first drawing to guide him, scrapes away the parts which he wishes to remain white in the finished impression. The stone must now be etched with acid, stronger than the common etching water, having one part of acid to twenty of water. The whole is then washed off with turpentine. This plan is generally used to print a middle tint from the second stone. The black impression being given from the first stone, a flat transparent brownish tint is given from the second, and the white lights are where the paper is left untouched. The dots are necessary to regulate the placing of the paper on the corresponding parts of the two stones. The paper for lithographic printing should not be so damp as for copperplate printing.

ON LACKERING.

As we did in our article on Bronzing, we shall, first, give directions for making the lacker, and afterwards proceed to describe the manner of using it. We have seen many receipts for making lackers, but the two following are the cheapest, and answer all the purposes necessary for brass goods; particularly as they can be used when necessary, along with any of the colouring liquids, directions for making which we shall also give. We shall first give a receipt for making

Common Lacker for Brass.

And in order to prepare this properly, it is necessary to select the best seed lac which can be procured, which must be washed in water, and then dried, and beat in a mortar to a coarse powder. Dissolve six ounces of this powder in two English pints of spirit of wine. They must be both put into a tin or glass bottle, which will hold nearly double the quantity meant to be prepared. Shake the bottle well, and then place it in a warm situation, near a fire or stove, which will hasten the solution. Shake the mixture occasionally, say every three or four hours, for the first and second day; allow it to stand still for twenty-four hours more, when the insoluble portion of the lac will have fallen to the bottom, then gently pour off the pure part into a clean bottle, and it is fit for use. This lacker will answer for all kinds of common brass work, tin plate, block tin, &c. It has a redish yellow colour, which may be heightened at pleasure by laying on two or more coatings. Its colour may likewise be easily varied by the use of the colouring solution to be afterwards described. When this lacker is used as a varnish to bronzed work, it gives it a brownish coloured ground. The only other lacker we mean to describe, is a

Fine Pale Lacker,

which is prepared with shell lac, instead of seed lac, and with highly rectified spirit of wine. The most transparent part of the shell lac must be selected, and it must be washed in clean water. It is then allowed to dry, and afterwards pounded into a coarse powder. Of which let ten ounces be taken, and mixed with two English pints of highly concentrated spirit of wine or alcohol. The mixture is then put into a glass bottle, capable of holding, as in the former case, about twice the quantity wished to be made. The bottle must then be stopped up, and placed in a warm situation, and shaken, as in the former instance. When the solution is completed, the clear part is to be gently poured off, and the remainder filtered through a sheet of strong blotting paper. This must then be added to the portion first poured off, and the residium which remains in the paper is then to be thrown away.

Both lackers must be preserved in a close bottle; and if properly made, and kept from the air, either of them will keep for years, and still be as good as ever. The last described lacker, when used without colouring, is scarcely seen upon varnished or dipped brass, but it will preserve it for many years, and prevent it tarnishing. We shall now describe how to make the best

Colouring mixtures for strengthening the Colour of either of the preceding Lackers.

1. Infuse one and a half ounce of turmeric root, and two drachms of gum tragacanth, in an English pint of spirit of wine, by keeping it in a warm place and shaking it frequently for two or three days. This infusion may be made stronger or weaker by using a little more or less of the gum.

2. The same quantity of turmeric root and spirit of wine, without the gum, gives a fine light yellow.

3. Infuse one ounce and a half of saffron in the same quantity of spirit of wine, and it will produce a dark redish colour; add equal parts of this and the 2d together, and it will give a strong bright yellow.

4. Dissolve one-fourth of an ounce of sap green in about half a pint of spirit of wine; add a few drops to any of the above, before mixing them with the lacker, and a bright greenish yellow will be obtained.

5. Dissolve half an ounce of gambouge, in about three-fourths of an English pint of spirit of wine, and it will produce a fine bright yellow.

6. Dissolve half an ounce of gambouge and half an ounce of gum tragacanth, in two pints of spirit of wine, and the mixture will give a fine gold colour.

When it is wished to use any of these colouring mixtures, pour out a little of the lacker into a cup or lacker dish, made for the purpose, and add the colour by a few drops at a time, until you have attained the shade which is wished. When a great quantity of work must be done at the same time, or at different times, of the same colour, the quantities of the lacker and colouring mixture ought to be carefully measured or weighed, as a great difference of shade will be the consequence of a very small difference in the quantity either of the lacker or the mixture.

We shall now proceed to describe

The Method or Art of Lackering,

which is indeed very simple. The work being finished, must be made perfectly dry, and entirely freed from grease. It must then be heated on a piece of hot cast iron, or a very clear fire, until it can scarcely be held in the hand. The lacker must then be laid on in very thin, and equal coatings, from two to five or six in number, according to the colour which it is wished the work should have: heating it always between the coatings, to harden the lacker, and make it adhere to the metal. Great care must be taken that no dust is flying at the time, as that would make the work have a rough or dirty appearance. The brush used for lackering, is a flat thin brush, made of camel's hair; it may be about an inch or three-fourths of an inch broad, and about one-eighth of an inch thick, and can be procured in the colour shops.

If at any time a part of the work is spoiled in lackering, whatever lacker may have been put on must be completely removed before any attempt is made to mend it; and this is done by boiling the work in a solution of pot-ashes in water—about one ounce of pot-ash to a Scotch pint of water. The work must be put among the boiling liquid, and in a few seconds the lacker will be disengaged. It must then be washed in clean water, and dryed in warm saw dust, and it is then ready to be again lackered. In this manner, likewise, the lacker must be removed from old brass work, before any attempt be made to clean it, or to lacker it anew.

ON THE LOSS OF POWER ARISING FROM THE USE OF THE CRANK.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—As there appears to be a fallacy in your Correspondent A. B.'s reasoning on the loss of power by the crank, which renders entirely useless his very ingenious invention, I hope you will not refuse to undeceive your readers.

A. B. will readily perceive that the simplest and most efficacious application of his invention would be, to have his wheels, which are to supersede the use of the crank, placed immediately above the piston rod, and to have a common rack attached to the piston rod, at each side of them. It is singular that this very contrivance was adopted, but not extensively applied, twenty years ago, by an ingenious mechanic of this place.—Now, suppose the wheel, or wheels, thus placed with an engine of three feet stroke, it is evident that the length of the rack, which is three feet, equals the circumference of the wheel, and that, consequently, the diameter of the wheel is (6 ÷ 3.1416) 1.91. If a crank had been employed, its diameter would have been three feet, and the average lever would have been almost precisely similar to the diameter of the wheel, say 1.91, so that in this respect no loss is sustained by the crank. This, to many ordinary mechanics, may appear paradoxical, and I confess I was deceived myself, till put right by a person who had more thoroughly studied the principles of mechanics. Besides that A. B.'s contrivance would gain no additional power over the crank, I should fear that if applied to a steam engine, the cylinder would be knocked to pieces in a short time.—Every stroke of the engine would come with its full undiminished power upon the ends of the cylinder, and, like the battering of cannon shot would inevitably destroy it. Nothing can suit the motion of the piston so well as the crank, for, by the assistance of the fly wheel, it brings it slowly to the turning points, and in place of allowing it to expend its force upon the cylinder, carries it sweetly round.

What appears to me to be the principal objection to the crank, is the irregularity of the motion. It must be well known, that the motions of the piston and of the fly wheel cannot both be regular, as they do not correspond with each other; so that, before a regular rotatory motion be produced, such a force must be communicated to the fly wheel as to enable it to control the motion of the piston—the power by which itself is driven.

Reasoning theoretically, I should doubt much the propriety of putting the engines on one crank. No additional power is gained; and as the motions of the two engines cannot correspond, unless when the fly wheel produces a perfectly regular rotatory motion, which controls the motions of both pistons, a considerable part of the power of one engine must be expended in counteracting the motion of the other. But experience is the best guide in these matters.

I am, Gentlemen, yours, &c.

W. C.

Paisley, 7th March, 1825.

LETTERS AND QUERIES.

HAND WEAVING.

To the Weavers of Glasgow.

Since the days of Noah, I suspect there has been very little improvement in hand weaving, if we except the fly-shuttle, which improvement took place about 40 years ago and remains nearly in the same state as when first invented. The first improvement I would have hand weavers adopt, is to weave at a given temperature the whole year round; I should think 65° or 70° of Fahrenheit's scale would be the best. Secondly, I would have weavers to pay strict attention to their dressing; the pulp of rice would make the best dressing for hard muslins, which may easily be regulated by some of the muriates, such as the muriate of ammonia, muriate of soda, or the muriate of magnesia; they never will get quit of dampness or hardness in their yarn, till they weave at a given temperature. Thirdly, all the flighters for fine weaving ought to be made of a metallic substance, with a fine spring. Fourthly, the beams both for cloth and yarn, ought to be made of common tin, (which will never cast, as wood does,) and can easily be made with spindles through them for their gudgeons. Fifthly, their heddles are also extremely badly contrived; no heddles ought to grasp the thread. On the heddles I will say no more at present, as a gentleman in town is busily employed in making metallic heddles, and I hope he will succeed and receive the reward his ingenuity merits. I see nothing to hinder the web from being dressed in the act of warping from the cope, and given out to the weavers dressed on tin beams.—This subject may be dry and tiresome to many, yet to the weaver and manufacturer it may be of the greatest consequence.

A Weaver.

Calton, 4th March, 1825.

MR. SAUL'S IMPROVED WINDOW.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—None who have made remarks on Mr. Saul's improved window shutters seem to be aware that the shops in Spreull's Land, Trongate, near Hutcheson-Street, had, originally, shutters of that construction, and from which, I believe, Messrs. Carswell copied theirs; I know not the precise period when that building was erected, but think it must have been prior to any yet mentioned as having shutters of that kind. They were, moreover, much more complete than Mr. Saul's plan; they had chains attached to the under part of the shutter passing over pullies with weights for a counterpoise; also a rope wound round a roller, and so connected with the shutter, and with a pulley at the bottom of the recess that by turning a winch the shutter could be raised or lowered at pleasure. But as the general practice now is, (at least in Glasgow,) to have windows directly under those of the shops, for lighting the flat below, the plan is wholly inadmisable, except by sinking the shutters to a very inconvenient depth, so as to clear both windows. I believe it was for this very reason that those above described were altered to the common mode, 12 or 15 years ago.

I am, Gentlemen,
Your most obedient servant,
G. M.

Glasgow, 12th March, 1825.

QUERY.

Will any of your readers give an account of the expense connected with the purchase of a patent right?

A Correspondent.

USEFUL RECEIPTS.

To Gild without Gold.—Put an ounce of sal ammoniac, and half an ounce of mercury in a crucible; cover it, and lute it well, for fear the mercury should escape. Put the crucible on a slow fire for half an hour, and then increase the heat till the crucible is red hot. When this is the case, throw the composition into cold water, and when it is cold it will be as hard as a stone. Break and grind it, and dissolve it in gum water, and wherever you lay a coat of this it will look like gilt.

To make a Paper which will not take fire.—Pound a quantity of alum in a mortar, add to it a small quantity of gunpowder, and dissolve the whole in three times its weight of water over a slow fire. Dip paper twice or thrice in this solution while it is warm, and then hang it up to dry. This paper is incombustible.

To stain Hair.—A solution of muriate of gold diluted with water, stains hair of a brown or auburn colour, and this colour is as permanent as the hair.

To cure the sting of Wasps, Bees, &c.—The best remedy for the sting of any of these insects, is to apply common salt moistened with water to the parts affected. Even when the insect has gone into the throat, a draught of salt and water has given immediate relief.

To banish Moles.—The smell of garlic is said to be so inimical to Moles, that it is only necessary to introduce a few pieces into their subterranean walks in order to get rid of them. Garlic has also been successfully employed against Grubs and Snails.

To give a lustre to Plate.—Dissolve alum in a strong ley; scum it carefully, then mix it up with soap, and wash your silver with it, using a linen rag.—This will give plate a fine lustre.

To preserve Milk.—Put a spoonful of wild horse radish into a pan of milk, and it will remain sweet for several days, either in the open air or in a cellar, while other milk will change.

NOTICES TO CORRESPONDENTS.

O., A Friend to the Circulation of Knowledge, G. M., Spectator, and X. Q., have been received. Chemicus is informed that we have not forgot our promise; and a series of Articles have been prepared, which would have already begun to make their appearance, had we not hitherto been prevented by want of room. If L. M'L. will take the trouble to call at our Publisher's, he will find an answer to his last. Mr. Buchanan of Paisley will please send us his address, and we will write him on the subject of his communication.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

Published every Saturday, by W. R. M'Phun, 155, Trongate, Glasgow, to whom Communications (post paid) must be addressed.

CURLL, PRINTER.

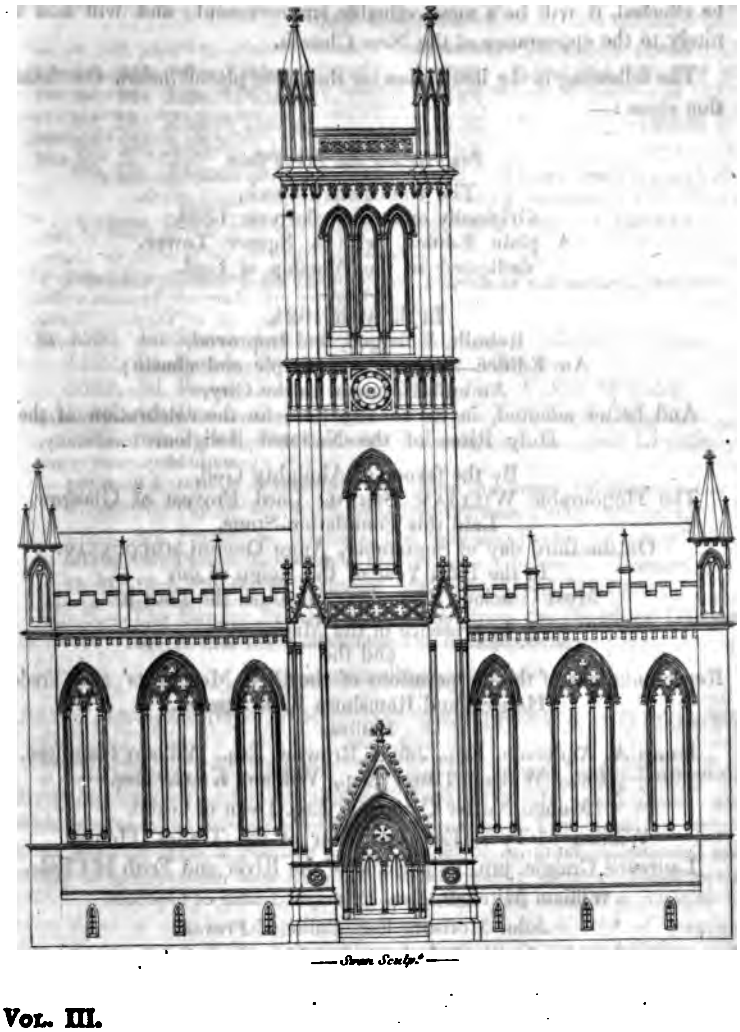
THE GLASGOW MECHANICS' MAGAZINE,

CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

> "What is strength without a double share
> Of Wisdom? Vast, unweildy, burdensome,
> Proudly secure, yet liable to fall
> By weakest subtleties, not made to rule,
> But to subserve where Wisdom bears command."

No. LXV. *Saturday, 26th March,* 1825. Price 3d.

THE RAMSHORN CHURCH.



Swan Sculpt.

THE RAMSHORN CHURCH.

This elegant structure, with an engraving of which (taken from the plan, which was obligingly lent us by Mr. Broom) we adorn our present Number, is likely to be, we think, the greatest ornament our City has for some time received.

We understand that the Magistrates have purchased up nearly the whole of the lairs in front of the building, so that there is every probability the street will be widened there, at any rate, whether the projected opening be carried through to the High-Street or not. If the latter project can be effected, it will be a most valuable improvement; and will add infinitely to the appearance of the New Church.

The following is the inscription on the plate placed below the foundation stone:—

Inscription on the Plate.

The Ramshorn Church,
Originally erected in the year 1720,
A plain Edifice, with a Square Tower,
dedicated to the Worship of God.

In the year 1824,
Rebuilt, Enlarged, and Improved,
An Edifice—elegant, yet simple and chaste;
An embellishment to the City,
And better adapted, in its construction, for the celebration of the Holy Rites of the National Religion.
By the favour of Almighty God,
The Honourable William Smith, Lord Provost of Glasgow,
Laid this Foundation-Stone,
On the third day of September, Anno Domini MDCCCXXIV,
In the Fifth Year of the Reign of our
Most Gracious Sovereign, George the Fourth,
In presence of the Magistrates,
and the
Representatives of the Corporations of the City, Merchants' and Trades' Houses, and Ramshorn Kirk Session.
Bailies,
James A. Anderson, Esq., James Browne, Esq., William Hamilton, Esq., William Lang, Esq., William Knox, Esq.
Mungo Nutter Campbell, Esq. Dean of Guild.
William M'Tyer, Esq. Convener of the Trades' House.
Laurence Craigie, jun. Esq. Bailie of the River and Frith of Clyde.
William Mitchell, Esq. Principal Bailie of Gorbals.
John Morison, Esq. Bailie of Provan.
Which Undertaking
May the Supreme God Bless and Prosper.

On the reverse of the Plate.

Committee of Council
To whose care the Erection of the Building is entrusted.
Bailie Hamilton, Convener.
Bailie Browne; Bailie Mitchell; Archibald Lawson, Esq.; Andrew Ranken, Esq.; William Rodger, Esq.; Peter Mirrlees, Esq.
Thos. Rickman, Esq. Architect.
James Cleland, Esq. Superintendent.
Messrs. Alexander Broom and John Galloway, Contractors.

Clergymen of this Church, and Population of the City at the time of their induction.

	Inducted in		Souls.
1st, Mr. John Anderson,............	1720,	Population,	15,162
2d, Mr. John M'Laurin, ...	1723,		......
3d, Dr. Robert Findlay,............	1756,		23,946
4th, Mr. Archibald Bonar,............	1783,		......
6th, Dr. Alexander Ranken, whom God preserve, ...	1785,	including Suburbs.	45,889

Census, 1821, 147,043—population 1824, supposed 153,043.

Parishes formed from the original Parish of Glasgow, after the Reformation.

In 1560, 1st Parish, Inner High, Sir Alexander Lauder, Minister.
1592, 2d Parish, Tron, Mr. John Bell, Minister.
1622, 3d Parish, Black Friars, Mr. Robert Wilkie, Minister.
1648, 4th Parish, Outer High, Mr. Patrick Gillespie, Minister.
1687, 5th Parish, Wynd, (now St. George's,) Mr. John Christie, Minister.
1720, 6th Parish, Ramshorn, Mr. John Anderson, Minister.
1763, 7th Parish, St. Andrew's, Dr. William Craig, Minister.
1782, 8th Parish, St. Enoch's, Dr. William Taylor, Minister.
1819, 9th Parish, St. John's, Dr. Thomas Chalmers, Minister.
1820, 10th Parish, St. James's, Mr. John Muir, Minister.

P. S.—The Barony Parish was disjoined from the Parish of Glasgow in 1595. Mr. Alexander Rowat was the first Minister.

POPULAR METHOD OF SOLVING QUESTIONS IN ASTRONOMY.

No. I.

Introductory Remarks.

By going through certain processes with instruments, we are enabled, upon the principles of geometry, to obtain the distances, not only of inaccessible objects upon earth, but even those of the heavenly bodies themselves, much more accurately than is generally believed. It is, however, little to be wondered at that the possibility of finding the distances of the sun, moon, and planets, any way near the truth, should be so much questioned and even denied, when we consider the abstruse and intricate manner in which the generality of treatises upon that subject are written.

To obviate the difficulties thence arising, and render the whole familiar to those unacquainted with mathematics, by making the methods for finding the distances of the celestial bodies simple and easy to be understood by every one, whatever their intellect or their education may be, provided they are acquainted with the rules of common arithmetic, is the principle object we have in view in the series of essays we mean to give on this subject.

It may be objected to the mode which we shall afterwards give, for finding the distance of the moon, that it cannot be correct owing to the arc which measures her paralactic angle being considered as a straight line; but the difference of such a small arc as that of the moon's paralax from a straight line is so little, that the error which arises from its being considered as such is hardly worth minding, when we consider the great difference between ours and the common mode with regard to simplicity. Indeed, scrupulous exactness is not so much our object, as it is to enable those who are unacquainted with mathematics to understand the manner in which the magnitude and distances of heavenly bodies are ascertained; and, therefore, if this is done, our principle object will be obtained.

The real method for taking and calculating the heights and distances of inaccessible objects upon earth, and those of the heavenly bodies, is by trigonometry; but as our present object is to make the method for finding the sizes and distances of the sun, moon, and planets, simple and easy to be understood by those who are acquainted with the simple rules of Arithmetic only, we shall begin by explaining the properties or nature of circles, as it is upon the principle of the known approximated ratio of the circumference of a circle to its diameter that the following method of finding their sizes and distances is founded.

Any flat thing which is round is a circle.

That point which is exactly in the middle of a circle is called its centre.

The breadth of a circle from one side to the other is called its diameter.

The length that it takes to go round a circle is called its circumference.

All circles, whether small or great, have this property, or they are of this nature, that if you multiply the diameter by 3⅐, the product will be the circumference of that circle; or if you divide the circumference of any circle by 3⅐, the quotient will be the diameter or breadth of it.

The circumference of all circles, whether small or great, is supposed to be divided into 360 equal parts, which are called degrees; each degree into 60 equal parts called minutes, and each minute into 60 equal parts called seconds, in the same manner as a yard is divided into 3 equal parts called feet, a foot into 12 equal parts called inches, and an inch into 4 equal parts called quarters, with this difference, that the length of a yard, a foot, or an inch, always remains the same; whereas that of a degree, a minute, or a second, depends entirely upon the size of the circle, for a degree is always the 360th part of the circumference, whether it be of the circle in which the earth goes round the sun, or of one a foot in diameter.

Easy method of finding the size of the Earth.

We shall now proceed to explain the method by which the size of the earth is found. It is well known that the sun appears to go round the earth exactly in 24 hours, and likewise that, of any two places lying directly east and west from each other, he rises sooner at the place in the east than at the one which lies west; for instance, he rises sooner at Edinburgh than at Ayr, because Edinburgh lies nearer the east where he rises, than Ayr does; consequently, he will be at the meridian of Edinburgh sooner than he will be at the meridian of Ayr.*

Let us now suppose, for the sake of convenience, that Edinburgh and Ayr are two places lying on the equator, directly east and west from each other at the distance of 69½ miles. Let a person who has a watch that keeps exact time, put it to 12 o'clock, when the sun is at the meridian of Edinburgh, then let him go to Ayr and note the exact time when the sun is at the meridian there, he will find that it will be 4 minutes past 12 in his watch before the sun comes to the meridian of Ayr, and of course that that body has taken 4 minutes to go from the meridian of Edinburgh to the meridian of Ayr. Now, since he will have found that the sun takes 4 minutes to travel over 69½ miles, which is the distance from Edinburgh to Ayr, it is evident that he will travel over 360 times that distance in going once round the earth; because there are exactly 360 times 4 minutes in 24 hours: therefore, let him multiply 360 by 69½ and it will give him 25020 miles for the circumference of the earth, and by dividing that by $3\frac{1}{7}$, he will find its diameter to be $7960\frac{20}{22}$ miles. The diameter of the earth, however, is generally said to be 7970 miles, the half of which is 3985.

$$\begin{array}{r}
360 \\
\underline{69\frac{1}{2}} \\
3240 \\
2160 \\
\underline{180 = \frac{1}{2}} \\
3\frac{1}{7})25020 \text{ circumference.} \\
\underline{7 \qquad\quad 7} \\
22)175140(7960\frac{20}{22} \text{ miles is the diameter of the earth.}
\end{array}$$

$$\begin{array}{r}
\underline{154} \\
211 \\
\underline{198} \\
134 \\
\underline{132} \\
20
\end{array}$$

The above method will answer the purpose of ascertaining the magnitude of the earth in no other place but at the equator. It is only adopted above as it is easier understood than the following, which can be put in practice in many parts of the globe. In any place, where there is a sufficient extent of ice for the purpose, take the altitude of any known star, (the north pole star for example,) with a quadrant, and then proceed directly northward or southward till the same star be raised or depressed one degree.—Then by taking the exact distance of the two places where you took your observations, and multiplying it by 360, you will obtain the circumference of the earth, and, by dividing the circumference by $3\frac{1}{7}$, you will obtain the diameter.

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* The meridian is that point of the heavens which the sun is at when he is directly south from any place.

DESCRIPTION OF THE SLIDE OF ALPNACH.

"Lo! where it comes,
"As if to sweep down all things in its track."

On the south side of Pilatus, a considerable mountain near Lucerne, are great forests of spruce fir, consisting of the finest timber, but in a situation which the height, the steepness, and the ruggedness of the ground, seemed to render inaccessible. They had rarely been visited but by the chamois hunters, and it was from them, indeed, that the first information concerning the size of the trees and the extent of the forest appears to have been received. These woods are in the canton of Underwalden, one of those in which the ancient spirit of the Swiss republics is the best preserved; where the manners are extremely simple, the occupations of the people mostly those of agriculture, where there are no manufactures, little accumulation of capital, and no commercial enterprise. In the possession of such masters, the lofty firs of Pilatus were likely to remain long the ornaments of their native mountain.

A few years ago, however, Mr. Rupp, a native of Wirtemberg, and a skilful engineer, in which profession he had been educated, indignant at the political changes effected in his own country, was induced to take refuge among a free people, and came to settle in the canton of Schwytz, on the opposite side of the lake of Lucerne. The accounts which he heard there of the forest just mentioned, determined him to visit it, and he was so much struck by its appearance, that, long and rugged as the descent was, he conceived the bold project of bringing down the trees by no other force than their own weight into the lake of Lucerne, from which the conveyance to the German Ocean was easy and expeditious. A more accurate survey of the ground convinced him of the practicability of the project.

He had by this time resided long enough in Switzerland, to have both his talents and his integrity in such estimation, that he was able to prevail on a number of the proprietors to form a company, with a joint stock, to be laid out in the purchase of the forest, and in the construction of the road along which it was intended that the trees should slide down into the lake of Lucerne, an arm or gulph of which fortunately approaches quite near to the bottom of the mountain. The sum required for this purpose was very considerable for that country, amounting to nine or ten thousand pounds; three thousand to be laid out on the purchase of the forest from the community of Alpnach, the proprietors of it, and the rest being necessary for the construction of the singular railway by which the trees were to be brought down. In a country where there is little enterprise, few capitalists, and where he was himself a stranger, this was not the least difficult part of Mr. Rupp's undertaking.

This distance which the trees had to be conveyed is about three of the leagues of that country, or, more exactly, 46,000 feet. The medium height of the forest is about 2500 feet; (which measure I took from General Pfyffer's model of the Alps, and not from any actual measurement of my own.) The horizontal distance just mentioned, when reduced to English measure, making allowance for the Swiss foot, is 44,252 feet, eight English miles and about three furlongs.

Along this line the trees descend, in a sort of trough, built in a cradle form, and extending from the forest to the edge of the lake. Three trees, squared, and laid side by side, form the bottom of the trough; the tree in the middle having its surface hollowed, so that a rill of water received from distance to distance, over the side of the trough, may be conveyed along the bottom, and preserve it moist. Adjoining to the central part, (of the trough,) other trees, also squared, are laid parallel to the former, in such a manner as to form a trough, rounded in the interior, and of such dimensions as to allow the largest trees to lie, or to move along quite readily. When the direction of the trough turns, or has any bending, of which there are many, its sides are made higher and stronger, especially on the convex side, or that from which it bends, so as to provide against the trees bolting or flying out, which they sometimes do, in spite of every precaution. In general, the trough is from five to six feet wide at the top, and from three to four in depth, varying, however, in different places, according to circumstances.

This singular road has been constructed at considerable expense; though, as it goes, almost for its whole length, through a forest, the materials of construction were at hand, and of small value. It contains, we are told, thirty thousand trees; it is, in general, supported on cross timbers, that are themselves supported by uprights fixed in the ground; and these cross timbers are sometimes close to the surface; they are occasionally under it, and sometimes elevated to a great height above it. It crosses in its way three great ravines, one at the height of 64 feet, another at the height of 103, and the third, where it goes along the face of a rock, at that of 157; in two places it is conveyed under ground. It was finished in 1812.

The trees which descend by this conveyance are spruce firs, very straight, and of great size. All their branches are lopped off; they are stripped of the bark, and the surface, of course, made tolerably smooth. The trees, or logs, of which the trough is built, are dressed with the axe, but without much care.

All being thus prepared, the tree is launched with the root end foremost, into the steep part of the trough, and in a few seconds acquires such a velocity as enables it to reach the lake in the short space of six minutes; a result altogether astonishing, when it is considered that the distance is more than eight miles, that the average declivity is but one foot in seventeen, and that the route which the trees have to follow is often circuitous, and in some places almost horizontal.

Where large bodies are moved with such velocity as has now been described, and so tremendous a force of course produced, every thing had need to be done with the utmost regularity; every obstacle carefully removed that can obstruct the motion, or that might suffer by so fearful a collision. Every thing, accordingly, with regard to launching off the trees, is directed by telegraphic signals. All along the slide, men are stationed, at different distances, from half a mile to three quarters, or more, but so that every station may be seen from the next, both above and below. At each of these stations, also, is a telegraph, consisting of a large board like a door that turns at its middle on a horizontal axle. When the board is placed upright, it is seen from the two adjacent stations; when it is turned horizontally, or rather parallel to the surface of the ground, it is invisible from both. When the tree is launched from the top, a signal is made, by turning the board upright; the same is followed by the rest, and thus the information is conveyed, almost instantaneously, all along the slide, that a tree is now on its way. By and bye, to any one that is stationed on the side, even to those at a great distance, the same is announced by the roaring of the tree itself, which becomes always louder and louder; the tree comes in sight when it is perhaps half a mile distant, and in an instant after shoots past, with the noise of thunder and the rapidity of lightning. As soon as it has reached the bottom, the lowest telegraph is turned down, the signal passes along all the stations, and the workmen at the top are informed that the tree has arrived in safety. Another is set off as expeditiously as possible; the moment is announced as before, and the same process is repeated, till the trees that have been got in readiness for that day have been sent down into the lake.

When a tree sticks by accident, or when it flies out, a signal is made from the nearest station, by half depressing the board, and the workmen from above and below come to assist in getting out the tree that has stuck, or correcting any thing that is wrong in the slide, from the springing of a beam in the slide; and thus the interruption to the work is rendered as short as possible.

We saw five trees come down; the place where we stood was nearer the lower end, and the declivity was inconsiderable, (the bottom of the slide nearly resting on the surface,) yet the trees passed with astonishing rapidity. The greatest of them was a spruce fir, a hundred feet long, four feet in diameter at the lower end, and one foot at the upper. The greatest trees are those that descend with the greatest rapidity; and the velocity as well as the roaring of this one was evidently greater than of the rest. A tree must be very large to descend at all in this manner; a tree, Mr. Rupp informed us, that was only half the dimensions of the preceding, and therefore only an eighth part of its weight, would not be able to make its way from the top to the bottom. One of the trees that we saw, broke by some accident into two; the lighter part stopped almost immediately, and the remaining part came to rest soon after. This is a valuable fact: it appears from it that the friction is not in proportion to the weight, but becomes relatively less as the weight increases, contrary to the opinion that is generally received.

In viewing the descent of the trees, my nephew and I stood quite close to the edge of the trough, not being more interested about any thing than to experience the impression which the near view of so singular an object must make on a spectator. The noise, the rapidity of the motion, the magnitude of the moving body, and the force with which it seemed to shake the trough as it passed, were altogether very formidable, and conveyed an idea of danger much greater than the reality. Our guide refused to partake of our amusement; he retreated behind a tree at some distance, where he had the consolation to be assured by Mr. Rupp, that he was no safer than we were, as a tree, when it happened to bolt from the trough, would often cut the standing trees, clear over. During the whole time the slide has existed, there have been three or four fatal accidents, and one instance was the consequence of excessive temerity.

I have mentioned that a provision was made for keeping the bottom of the trough wet; this is a very useful precaution; the friction is greatly diminished, and the swiftness is greatly increased by that means. In rainy weather the trees move much faster than in dry. We were assured that when the trough was every where in its most perfect condition, the weather wet, and the trees very large, the descent was sometimes made in as short a time as three minutes.

The trees thus brought down into the lake of Lucerne, are formed into rafts, and floated down the very rapid stream of the Reuss, by which the lake discharges its waters first into the Aar, and then into the Rhine. By this conveyance, which is all of it in streams of great rapidity, the trees sometimes reach Basle in a few days after they have left Lucerne; and there the immediate concern of the Alpnach Company terminated. They still continue to be navigated down the Rhine in rafts to Holland, and are afloat in the German Ocean in less than a month from having descended from the side of Pilatus, a very inland mountain, not less than a thousand miles distant. The late Emperor of France had made a contract for all the timber thus brought down.

REPORT

On the Manufacture of Gas obtained from Pit Coal, and on its relative value to Oil Gas. With some Remarks affecting the proposed Gas Establishment for the Town of Dundee.—By Mr. John Nelson, *Civil Engineer, Glasgow.*

[Communicated by the Author.]

The subjects embraced in this report are chiefly practical. In the erection of new works, the principles of which are not fully developed, it is always safer to adhere to practice than to trust to speculations, which frequently disappoint our expectations. Accordingly, besides what practice I have had, I have availed myself of the experience of my brother in the Gas Works here, and of others employed in conducting several of the works in England. We shall therefore be able to guard against several errors and defects that have hitherto occurred in the construction of gas apparatus, (which can only be discovered in a course of trial,) and to take advantage of any improvements that from time to time have been made in its structure; and, moreover, to adopt any other methods for facilitating the manufacturing process, so far as already known.

As introductory to these views, and in concurrence with some of your queries, when at Dundee, I shall make a few remarks regarding various complaints that have been made against gas establishments, and the means of preventing, as much as possible the inconveniences complained of.

Complaints against Gas Works.

A gas establishment must from its nature be subject to an impression which pretty generally prevails against public works of whatever description, being set down in a genteel neighbourhood. But this feeling ought not to be stronger here, than against our founderies, our spinning manufactories, and many other mechanical and chemical operations necessary in promoting the useful arts. Accordingly, although at the first erection of the Glasgow Gas Works the feeling was strongly against it, yet now I am not aware that any offensive smell is either felt or complained of in the neighbourhood. This prejudice has gradually worn off, and any complaint now arises from leaks of gas which casually occur in the streets, and not from the interior of the works. Such occurrences produce the only smell that can reasonably be complained of; and this smell, although unpleasant, is attended with some advantages, particularly in giving notice of danger.

It is admitted that the coal-tar and other aqueous substances produced in considerable abundance in this sort of manufacture, are offensive, and the lime used for purifying, when saturated with sulphureted hydrogen, carbonic acid, gas, and ammonia, also give out a disagreeable smell. But these products are almost the only grounds of complaint, in the manufacturing process, and exist chiefly within the walls of the establishment, so as not to form any subject of complaint even to the neighbouring proprietors.

Attempted Remedies.

A patent was some years ago obtained for a dry lime purifying apparatus; but its absorbent powers are found by Mr. Smith of Birmingham and others, to be about two-thirds weaker than when the lime is used in a liquid state; and has nothing to recommend it but that of getting quit of the additional water necessary to bring the lime into a liquid form. Its use will not, therefore, prevail, except in cases where the works may be so much surrounded with neighbouring buildings, as to make it extremely difficult to get quit of the liquified lime.

Impressions of danger.

Having mentioned above that the gas, when allowed to escape, warns us of the approach of danger, we shall also make a few remarks on this subject, because on this as well as on the other an unfavourable impression pretty generally prevails, particularly among communities unacquainted with its use.

Sources of danger.

The sources from which any danger can be apprehended may be classed into two. The one the gas-holder, the other the leading, main, and pipes for conveying and distributing the gas in different parts of the town.

Accidents by explosion, and the causes.

On the first class I am not aware that in any of the numerous gas-holders, employed in various establishments for manufacturing and supplying on a large scale, any accident has occurred from explosion, except in an instance a few years ago at Manchester, mentioned by Sir William Congreve in his report to Lord Sidmouth, on the state of the gas works in the metropolis, for January, 1822; and this occurred in the first filling of the gasometer, through the ignorance and incautiousness of the persons employed. The atmospheric air not having been exhausted from the gas-holder, was allowed to mix with the carbureted hydrogen as it entered, and some of the workmen wishing to ascertain whether the gas-holder was tight, thoughtlessly applied a candle to a leak of considerable magnitude, the gas immediately exploded, tore in pieces the gas-holder, and otherwise did serious damage. It is said one person was killed.

Some few casualties have also happened, and some mischief has been done, by means of gas issuing from the pipes; but, in these instances, the mischief has not arisen from any ordinary leak or escape of gas; but by water drips or plug holes having been left open by careless workmen, or by breakage in the pipes. An instance of this latter kind lately happened in London. Some part of the gas pipes had been incautiously undermined, while the street was undergoing repair; a fracture was the consequence; and, on the approach of a light which a person carried into a wine vault under the street, contiguous to the fracture, the gas immediately exploded; overturned the pavement, and did some mischief in the vault; but nothing of a very serious nature. These cases, however, have happily been but few; and the safety and success with which gas works in general have been conducted, promise that, with ordinary care, no danger need be apprehended. Indeed, there is no known possibility of explosion occurring, either in the gas-holder or distributing pipes; it being ascertained by undoubted experiments, that coal gas cannot be inflamed, even by a candle, till it comes in contact with a body of atmospheric air, from 5 to 10 times its own bulk, as the gas may vary in its illuminating power.

That such a mixture of atmospheric air should take place in the gas-holder or leading pipes, can scarcely be supposed. Almost the only case in which it can occur in the gas-holder, would be at its first filling with gas. In such a case, the gas-holder, without having been previously exhausted, must be charged with atmospheric air. The gas would be forced to combine with it, and until this is discharged, it would be unsafe to approach it with a light, in the event of any large leakage.

Fractures or openings left in the conveying pipes, if undiscovered, may produce partial explosions, and do serious mischief, particularly where vaults or common sewers are contiguous; and accordingly, any casualties that have happened, have been in such places where the two airs had lodged and attained to an explosive mixture.

Although an impression is somewhat prevalent, that even the apertures of a burner may emit, by escape, so much gas as to be the cause of danger in a close room; yet we are not aware that an instance of this kind has at any time happened, and it does not seem at all probable that it ever should, from the small quantity of gas that could in any place be emitted through a regular burner, this being always in proportion to the area of the chamber lighted; so that, in any case of a burner being left open, we might calculate on a continued emission of gas, from one to two days and nights, before even a chamber almost air-tight, would arrive at an explosive mixture.

Means of avoiding causes of Nuisance.

It was stated that the odour of coal tar, and the lime when saturated with sulphureted hydrogen, &c. &c. are almost the only offensive products within the works, and that the boundary wall sufficiently prevented these from being any subject of complaint to surrounding proprietors. But it might have been mentioned, that, in carrying off these offensive vapours, the chimney stalk is also of very material benefit, as it forms a powerful ventilator for these as well as for the smoke. It ought, therefore, to be large in its section, and of considerable altitude, by which means it inhales a more powerful current of fresh air, which either absorbs or carries off the surrounding vapours in a dissipated state.

In disposing of the tar and saturated lime, in situations where they cannot be carried off by a stream of water, or by the ebbing and flowing of the sea, perhaps the next best method to get quit of them will be by evaporation, as is the practice at the works in Glasgow. And as this can be effected by the heat of the furnace wall around the retorts, the only expense incurred will be in the purchase of the evaporating pans; and, as these may be made of thin iron, they can be obtained at a small expense. In regard to the management of the tar, it has hitherto, for the greater part, been carted away in close vessels from the works, to be boiled for the purpose of coating wood, iron, &c.; but should some experiments now in progress succeed, to convert it into gas by passing it through a second retort, under a bright red heat, it would thus be turned to an economical purpose, and any nuisance that might otherwise be complained of in preparing it for a marketable purpose, would be got quit of.

To avoid complaints of smell, or chance of accidents which arise from escapes of unconsumed gas, and which, we think, with ordinary care may be greatly prevented; attention should be paid, in the first place, to see that all the pipes are sufficiently tight, well laid, and jointed in the best possible manner; and that the water lute valves for shutting off the gas, and drips for taking of the condensed vapour generated in the pipes, be so constructed as to avoid the possibility of the gas escaping at these points. If this is well attended to, there will in general be no cause of complaint, or of annoyance from smells, and little danger of any serious mischief occurring.

(To be continued.)

MR. BARLOW'S METHOD OF CORRECTING OBSERVATIONS MADE BY THE COMPASS IN SHIPS.

It has been found that in ships, the needle of the compass is materially affected by the iron used in the construction of the vessel. As that metal is now employed in much greater quantities than formerly in ship-building, the effect thus produced has been growing in magnitude; and, in some cases, the error is found to amount to no less than 30° or 40°, or even more. Such a source of error, without some mode of correcting it, would have rendered it necessary to continue to construct ships in the old method; and thus the important advantages must have been relinquished, in a great degree, which are known to result from the use of iron, in the construction of cables, capstans, and various other articles in ship-building.

Professor Barlow, of the Royal Military Academy at Woolwich, having instituted a series of experiments on magnetism, made several important discoveries. One of the most valuable of these is the curious fact, that the attractive power of iron depends not on its weight, but on its surface; a hollow iron ball affecting the needle as much as a solid one of the same diameter. From this property, and from the attraction being greater, the nearer the needle is placed to the attracting body, it follows that a plate of iron, of inconsiderable weight, placed near a needle, may attract as powerfully as large masses placed at greater distances. From this simple principle, Mr. Barlow derived the discovery of a method of effectually correcting the errors already described. This he effects, by placing a plate of iron of twelve or fifteen inches diameter, in the line drawn from the compass to the common centre of attraction of all the iron in the vessel, or in the continuation of that line beyond the place of the compass, the position of the plate being in each case determined by experiment. In the latter of the two positions, the plate is so situated as to attract the needle with exactly the same force as all the iron in the vessel. By this means the effect of the iron is neutralized, and the needle takes the same direction in every position of the vessel, and at all parts of the earth, as if it were influenced by no other power than the magnetic attraction of the earth. When the plate is placed between the compass and the magnetic centre of the vessel, it is fixed in such a position as exactly to double the error. Hence, the direction of the needle being observed, first when the plate is removed, and then when it is in its position, the difference will evidently be the error; and consequently the true direction will be known.

Such is the very simple and beautiful, and at the same time highly valuable discovery of Mr. Barlow. For this, he has already received from the Board of Longitude £700, the largest reward that they have it in their power, by their constitution, to bestow; but it is to be hoped, that he will yet obtain other more adequate remuneration. In the meantime, he has secured the invention by a patent; and means to supply the plates in all sea ports, with the necessary directions for using them.

In consequence of the great importance of this, it has been truly said "that if any vessel be in future allowed to go to sea, and especially to high latitudes, without the precautions so easily pointed out by Mr. Barlow, the loss both of property and lives, in the event of shipwreck, may in most cases be fairly attributable to the owners."

HUMAN SUSTENANCE.

Calculation of the Consumption of Landed Produce by the Human Species.—By Mr. W. Pitt.

I reckon that a healthy grown person of the male sex, who uses much exercise, and *who has what he chooses at command*, will consume, in bread, the produce of a pound weight of flour *per day*, or 365 lbs. *per annum:* this, allowing for the bran, will be the product of one-third of an acre, and allowing for potatoes and other vegetables, will consume in vegetable food, half an acre; and in animal flesh, ½ lb. per day, 182½ lbs. per annum, or the full produce of one acre; and in butter and cheese the product of half an acre;* and in beverage from malt liquor, the produce of at least one acre of barley: in all—supposing the land of good quality—the produce of three acres.

The allowance for *beverage* may, by some, be thought high, but the home-brewed ale of my neighbourhood has six bushels of malt at least, to a forty gallon cask; so if a person drink *only four pints of ale per*

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* I suppose butter produced only in half the proportion of animal flesh, or 90 lbs. per acre per annum.

day, it is 182½ gallons per annum, or the produce of full twenty-six bushels; a trifling allowance for small beer at meals will rise it up to the produce of more than an acre. I believe *I can find people in plenty who would undertake to drink double this quantity, and many who really do so.*[*]

For the female sex, who are grown up, I would deduct the beverage, and allow them each the produce of two acres; and for those beneath the age of puberty in either sex, per head, the produce of one acre.

In order to ascertain the breadth of land necessary to support any given number of the human species, I would divide them into three classes, in equal numbers as above; 1. the male sex grown up; 2. the female sex grown up; 3. children of either sex; and one of each, as above, will consume the produce of six acres, or two acres per head, per annum.

If we suppose the number of horses kept for draught, harness, the saddle, and all other purposes, to be equal to one-tenth of the number of human beings; and that each horse, as before calculated, consumes the produce of three acres of good land, then thirty persons and three horses will require sixty-nine acres; to avoid fractions, I will say seventy acres of such land; and suppose sixty acres to go to support thirty human beings, and ten acres to the three horses, thus the horse consumes one-seventh part of the produce of the land, and the human species six-sevenths.

But this calculation is made for the prime soils of Leicestershire; to adapt it to the whole kingdom, I would divide the land into three classes, and suppose one-third of it as good as Leicestershire, one-third only half as good, and one-third a medium between the two; then the breadth of land must be increased as two to three, or it will require one hundred and five acres of the average land of the kingdom, in its present state of cultivation, to maintain thirty persons and three horses, or three acres and a half per head upon the whole number of human beings.

By this calculation, *seven millions of people, living as is the custom now in England*,[*] would require twenty-one millions of acres of land cultivated for their own subsistence, and three millions and a half of acres for the horses kept for their convenience, their luxury, and their pleasure.

I know some people will object that the allowance of land for horses is insufficient, and that the produce of much more land is consumed individually by that animal; and so it may, where they are kept in luxury; but I know that *thirty bushels of oats*, together with the grass and hay from the proportion allowed of medium land, will well *support a working farm horse*, and that if more is given to hunters, and others who make great exertions, less is also given in many cases. The same observation will hold good respecting the human species, where the luxury and extravagance of some are counter-balanced by the abstinence or poverty of others.

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[*] Of the labouring part of the community, how many thousands are there to whom *half* this quantity were the highest luxury! But we must remember, that Mr. W. Pitt has prefaced his calculation of the consumption of landed produce, by the salutary proviso, that the individual "*has what he chooses at command.*" Probably the taxes of his *illustrious namesake*, were founded on that *assumption*.

[*] Rather as "*was the custom in England*," for it may be greatly doubted, whether there are now in England one-tenth of this number, having "*what they choose at command.*"

If the above data were correct, it seems not difficult to deduce from them the due proportion of cultivation of different articles to suit the present modes of living; or to point out such economical alterations as to tend to support a more numerous population: thus, a farm of 210 acres of medium land is to support sixty human beings and six horses; for the former,

Wheat will be wanted upon,......	20	acres.
Barley at least upon..............	20	—
Oats for horses upon...............	10	—
Beans and Pease for hogs and other stock upon	10	—
Potatoes or Turnips, or Green crops upon.......................	20	—
Wheat fallow upon.....................	10	—
Horse pasture,........................	10	—
Cow pasture,...........................	40	—
Sheep pasture,........................	40	—
Horse hay on 10 acres, cow hay on 20,............................	30	—
	210	acres.

From this calculation it should appear, that, to supply the present demand, near *one-tenth* of the cultivated land should be sown with wheat, and the same proportion with barley; that two-sevenths of the whole breadth of land should be cultivated for grain or pulse, one-seventh green crops of fallow, three-sevenths pasture for live stock, and one-seventh mown for hay.

It also appears, that a much greater population may be supported from the same breadth of land, upon vegetable food, and the produce of cows in milk, and its produce, than can upon animal diet, and fermented liquors used as beverage; and that these two latter are almost equally a luxury; as an individual, by indulging either in the one or the other, may clear off the produce of nearly an equal breadth of land.

LETTERS AND QUERIES.

ON FIRE ENGINES.

To the Editors of the
GLASGOW MECHANICS' MAGAZINE.

GENTLEMEN,—From your notice in the Mechanics' Magazine of the 26th February, of my former communication, I am encouraged to present you with my ideas on the subject of raising water above its level. With regard to water engines employed in extinguishing fire, I am persuaded that, by compressure of the water in the engine, it could be thrown to a much greater height than by the engines at present in use. The powerful effect of the bellows is by the compressure of air; and by an engine for water on the same principle, in which the mechanical powers could be employed in the compressure, I doubt not but as much force could be given to water as the engine and pipes could sustain; and as, by the operation of such an engine, the vacuum would be much greater than by the pump, it could easily supply itself, even although the water were much below the level of the engine. I am likewise of opinion, that, on the same principle, water could be raised above its level by an engine being laid in a river, by which the force of the current could be employed as the compressing power.

I suppose it is not necessary at present to offer any thing with regard to the construction of engines on the above principle; what I wish from you, or any of your Correspondents, is, your opinion whether the principle is good or not, or likely to be anywise useful.

I am, yours, &c.

A FRIEND to the CIRCULATION of KNOWLEDGE.

Edinburgh, 16th March, 1825.

To the Editor of the
GLASGOW MECHANICS' MAGAZINE.

GENTLEMEN,—In No. LX. of your valuable Magazine, V. inquires whether there be any truth in the observation so often made by washerwomen, that the temper of the wearer has considerable influence on the cleansing of the shirt. I have heard many remarking, on this assertion, that it is nonsense, and not founded in truth. If I, however, may venture to give my poor opinion on the question, I would beg to differ entirely from these gentlemen; and to say, that the observation is founded in fact. What every body says, it is allowed, must be true: now, every washerwoman in the country, I believe, affirms the fact, and who should know better than they? It is the oldest thing I recollect of for our washerwoman to say, that my shirts were more easily washed than my brother John's, who was none of the quietest of men, and not at all like me. But washerwomen not only affirm the fact, they give a reason for it; a thing not very common with uneducated persons. They say that the cause is simply this: that the ill-natured man perspires more than the man of easy temper; and this reason is to me certainly perfectly sufficient.

I am, your admirer and well-wisher,
PETER PEACEABLE.

Queen-Street, 20th March, 1825.

To the Editors of the
GLASGOW MECHANICS' MAGAZINE.

GENTLEMEN,—If you, or any of your worthy Correspondents, could solve the following query, it would oblige,

Your obedient Servant,
T. O.

Tarbet-Street, 19th March, 1825.

Does waterproof cloth, or leather, if worn next to the skin, prevent perspiration? And if so, Have they the same effect when used for a great-coat, or shoes?

[Certainly neither waterproof cloth, nor leather, although worn next the skin, prevent perspiration; we should rather think they promote it. But they have a very injurious effect when so worn: they retain the perspiration, prevent it from evaporating, and keep the skin constantly damp and cold. Any one wearing waterproof socks below his stockings, must always have cold, damp, uncomfortable feet; and we have as little relish for waterproof shirts. The objection we have always had to flannel worn next the skin, is something of the same kind. It promotes perspiration, and retains it upon the body. If we change our flannels often, the effect is weakening; if we wear them long, they become damp, dirty, and disagreeable. The proper use of waterproof cloth is for great-coats, or cloaks; and of waterproof leather for clogs, to be worn above the boots or the shoes in damp weather. They then keep us dry; and they do not prevent the perspiration from evaporating.]

To the Editors of the
GLASGOW MECHANICS' MAGAZINE.

GENTLEMEN,—I am a reader of your excellent Magazine, and wish heartily for its prosperity; and, as I derive much useful knowledge from it, and seeing that its intent is for the ignorant to get information, I humbly request you would be pleased to insert the following, requesting the opinion of some of your Correspondents; and when you find a satisfactory answer, to give it publicity.

Having seen the coppersmiths bending wires, by means of three rollers, to any circle necessary, I conceived that bars of iron for cart-wheel shoeing, of 2½ inches broad, and from 5-8ths to an inch thick, might be bent in the same manner, perhaps with the intervention of a few wheels and pinions, with as great ease (though not so quick) as small wires.

I am, yours respectfully,
J. J.

NOTICES TO CORRESPONDENTS.

Liber—G. J. R.—V.—O.—E. S.—E. C.—A Reader—have been received.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

Published every Saturday, by W. R. M'PHUN, 155, Trongate, Glasgow, to whom Communications (post paid) must be addressed.
CURLL, PRINTER.

THE GLASGOW
MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

No. LXVI. *Saturday, 2d April,* 1825. Price 3*d*.

PLAN OF MAKING ROADS, SEISMATIC MACHINE, &c.

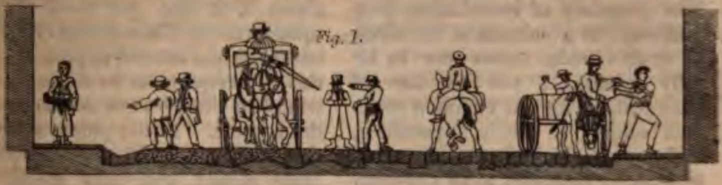
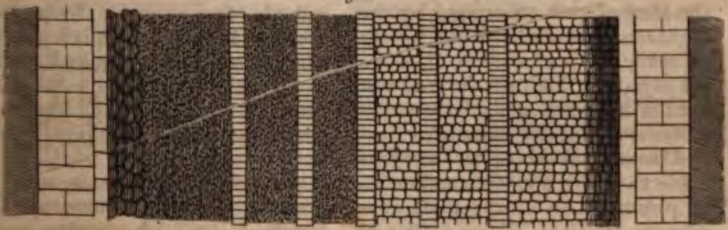
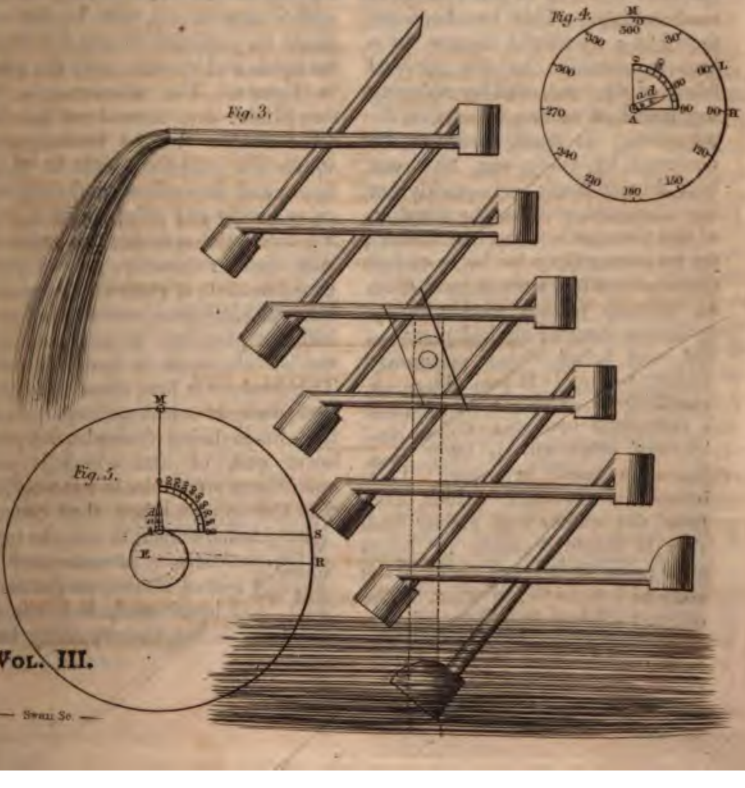


Fig. 2.





Vol. III.

— Swan Sc. —

PLAN OF MAKING ROADS.

THE Plate represents a Road or Street laid with the *Stone-tracks,* recommended by Mr. STEVENSON, civil engineer, for all great thoroughfares, and for all steep acclivities. The propriety of introducing Iron Railways as a substitute for ditch or small Canals, seems now to be fully admitted; and the use of Stone-tracks for our common roads is a subject of much importance, and one to which the public attention ought forthwith to be directed. Before more particularly explaining the kind of path illustrated by the engraving, we shall, for the benefit of many of our readers, describe the structure both of the common road or highway, and of the street or causeway of this country.

Common Road.—The exertions made to obtain a smooth surface is, at present, one of the most conspicuous features of our system of road-making. This has been effected in a wonderful degree, by a greater attention to the general fabric of the road, and by reducing the metal or stones to smaller dimensions. It must, however, be observed by every one, that our best formed roads very quickly get into disrepair, and that the situation of the traveller is rather tantalizing; for no sooner does he begin to feel the comforts of a smooth path, than an irksome tedium ensues, while he passes along newly laid pieces—the road being almost constantly under repair. Where there is much traffic, it absolutely requires a continued operation, and an unwearied attention, to keep these fine-spun roads in order. This, indeed, is rendered obvious, even from the quantity of clayey stuff that is raked together in heaps after rains, or is blown about in the state of dust in dry weather. The original cost of a stratum of properly broken road-metal, measuring eight inches in depth, in such a situation as Edinburgh, where good rock is to be had in abundance, may be stated to be at the rate of about £ 2, 10*s.* per rood of 36 square yards. This course of metal laid upon the several approaches to this city requires to be renewed, or would be wholly worn out, in about three years. In the public streets, the waste would be proportionally more rapid; and this seems to render the use of small metal unsuitable for a much frequented thoroughfare. Where it has been tried, in some instances, in England and South Wales, the inhabitants complain "of having all the dust of summer, and all the dirt of winter."

Causeways.—Were it not the great expense of causeway, its roughness, and the jarring noise which attends it, this would no doubt be generally resorted to both for roads and streets, as is the case in France. The causeway is of two kinds; one termed *ruble,* the other *aisler.* In the former, the stones are irregular, both in their figure and dimensions, and they receive hardly any chipping or dressing from the quarrier or paviour. The aisler causeway, on the contrary, consists of stones well assembled, carefully hammer-dressed, and laid in regular courses across the street, upon a bed of sand. This mode was long considered the perfection of road-making. But the stones being formed with the lower end, or that which is set upon the ground, somewhat smaller than the upper surface, they consequently touch only at or near the top. When, therefore, a pressure comes upon one end of a stone so formed, and set in loose sand, it is easily depressed; when the causeway becomes dislocated, and gets into numerous hollows. The dislocation of the ruble causeway is still more rapid, as the stones rest upon a smaller surface than either the aisler causeway or even the rounded stones in general use in the streets of country towns. These last form a very rough and unpleasant road; but in connection with the stone-tracks now recommended, they would form most durable and excellent streets.

In the neighbourhood of Edinburgh, the expense of aisler causeway is about eight guineas per rood; while ruble work may be estimated at about one-half of that sum. Perhaps the finest specimens of British paving are those of the Commercial Road of London, Great Sackville Street in Dublin, and Leith Walk of Edinburgh. This last forms almost the only thoroughfare to the Port; it is nearly two miles in length, and its breadth between the curb-stones, which line off a spacious footpath on each side, may be taken at an average of 58 feet. It is now fourteen or fifteen years since it was converted, from a very bad common road, into this specious causeway. Although the surface of this street now exhibits many inequalities, yet, with a very little repair, it has continued a good road during that comparatively long period, and may continue still as long in the same state. Now, if we compare this with the continual repairs which common roads with a similar traffic demand, we presume that a small-metal road would have required to have been renewed every third year, or at least five times since Leith Walk was paved with aisler causeway. Hence it follows, that, in the course of fifteen years, this, which cost eight guineas, must, upon a moderate calculation, have cost about fifteen guineas per rood, including the expense of raking mud, and other contingencies, to which the causeway is but little incident. We here also lay out of view the inconveniency of repairs almost constantly going on, besides the much greater quantity of dust inseparable from the common road. The causeway is, therefore, upon the whole, more economical than the small-metal road; but this last is more pleasant for the traveller.

Wheel Tracks of Stone.—If any one can suggest a system of road-making which shall lessen the ultimate expense, and avoid the inconveniency attending the frequent repair of small-metal roads, and, at the same time, secure all the advantages of a smooth and uniform railway, with the duration of the aisler causeway, we doubt not that its importance will at once be admitted: and if its practicability be also evinced, we trust that it will soon be brought to the fair test of experiment. The chief improvement alluded to, as proposed by Mr. STEVENSON, is effected by laying Stone-Tracks, of a simple construction, upon a firm foundation, if not throughout the whole extent of our principal roads, at least upon all their acclivities which exceed a greater rise than at the rate of 1 perpendicular to 26 horizontal feet. (An undulating line of road which obliges the carrier, in most instances, to modify his load to one-half of what his horse can take along the more level parts.) It is likewise proposed, that the leading streets of all towns and villages situate upon the principal highways, should be laid with these stone-tracks. The traveller would then glide smoothly along, instead of being accompanied with a thundering noise and jolting motion most unpleasant to himself and the inhabitants of the respective places through which he passes.

Perhaps the advantages of this system cannot be better exemplified than by noticing an experiment made in presence of some of the Directors of the Forth and Clyde Canal Company, upon a set of cast-iron tracks, laid upon an acclivity rising at the rate of about 1 in 15 to Port-Dundas, near Glasgow. Here one horse actually drew up a load of three tons on a cart weighing 9 cwt.* In this case, the horse proceeded up hill without much apparent difficulty till he reached the top, and was about to enter on the common causeway, when he could proceed no farther, although the road had now become level. The carters frequenting this road agree, that their horses had formerly greater difficulty in taking up 24 cwt. on the causeway, than was now experienced with 3 tons. How great, therefore, must be the beneficial effects of such an immense acquisition of power as even the partial introduction of wheel-tracks is calculated to afford to the traffic of the country.

It is to be regretted, that cast-iron, which would be so much more durable than stone, is so expensive. It may also be noticed as a draw-back to the use of that material for the thoroughfare of a street, that its property of hardness and of getting smooth, even to a state of polish, becomes proportionally disadvantageous. The stone-tracks, on the contrary, preserve a certain degree of roughness, and the numerous joinings suggested by this plan are also favourable to the safety of the horse.

The individual component stones of the wheel-tracks hitherto very partially in use, extend from 3 to 4 feet in length, are about 10 or 12 inches in breadth, and 8 or 10 inches in depth. In the neighbourhood of Aberdeen, there is a granite railway of this description, which runs several miles along, or in conjunction with, the common road. The stones of the tracks recommended by Mr. STEVENSON, on the other hand, are of a cubical form, measuring only from 6 to 8 inches in the lengthway of the track, and 12 to 14 inches in depth, 18 inches in breadth at the base, and 12 inches at the top or wheel-track. The stones are therefore proportionate in all their dimensions; for, unless they contain a mass of matter corresponding to their length, they will be found to want strength and stability. It would hardly be possible to keep slender stone-rails in their places, and hence the chief benefit of a connected railway would be lost. On the other hand, very large materials are difficult to be got, and are also more expensive in carriage and in workmanship than stones of a smaller size. The Italian wheel-tracks are composed of stones 2 feet in breadth, and of various lengths. To lessen the risk of horses falling, these broad stones are kept in a rough state, by occasionally cutting grooves with a pick-axe upon their upper surface. A mode of paving with large blocks of granite, chequered or cut in this manner, has been tried in some of the streets of London. In order, however, to give pavement of this kind the necessary stability, the blocks would require to have their dimensions equally large on all sides, the expense of which would be too great. But cubical stones of the size now recommended, may be procured at a moderate price, and throughout a great range of country; while the tracks, if properly laid, will actually be more stable than if blocks of larger dimensions were employed. For we may notice, that a carriage wheel rests or impinges even upon a less surface than one inch of its track at a time, in the course of each revolution round its axis: hence, it may be conceived to produce a kind of compensating effect, connected with the use of small stones, which prevents the tremour from being communicated beyond the limited sphere of each particular block, and, consequently, extending only a few inches. This system of paving was originally proposed for the Main-Street of Linlithgow, forming part of the great western road from Edinburgh to Stirlingshire. Notice has since been taken of it in the Transactions of the Highland Society, Vol. VI., and in Dr. BREWSTER's Encyclopædia, under the article "Roads;" and a correct idea of the plan will at once be acquired by examining the prefixed sketch. By using tracks of this description—giving the stones a proportionally broad bed—and laying them upon a firm foundation, (which is indispensable,) we should have our streets, and the acclivities of our highways, rendered smooth and durable—avoiding, at the same time, the great expense and inconvenience of the common road, and the irksome noise and jolting motion of the causeway. Specimens of these tracks have just been laid in some of the principal streets of Glasgow, by Mr. FERRIE * the superintendent; they have also been submitted to the Trustees of the County of Edinburgh; and brought under the notice of some of the Parishes of London.

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* We trust we shall here be excused for attempting to point out to our Southern friends the benefit of light single-horse carts. The team is indeed more like English wealth, but it is really impossible to make even two horses work equally. Much as we admire that noble animal, the dray-horse of London, we cannot approve of the policy of yoking them in teams. Our feelings have, indeed, been often agitated by seeing the whole load of several tons thrown upon the shaft horse at almost every turn from one street to another. We are, however, far from disapproving of four wheels; and with pleasure we notice an improvement lately made by Mr. STUART MENTEATH of Closeburn, who has had single-horse waggons with four wheels applied to the ordinary purposes of his estate. These waggons are constructed upon the principle of those of Switzerland; they are 10 cwt., on which a horse, weighing about 11 cwt., takes a load of 30 cwt. between Edinburgh and Closeburn, a distance of 66 miles. This gentleman, whose knowledge in such matters is extensive, estimates, that if wheel-tracks were laid upon the principal acclivities of the road, his horses could work with a load of about 2 tons.

The tracks may be formed of granite, of whinstone, (*i. e.* greenstone or basalt,) or any of the hard varieties of rock capable of being hammer-dressed. Such materials abound in Scotland; in many parts of the north of England, as far south as the approximating sources of the Tees and the Ribble, and in all the districts of Wales. One or more sets of tracks may be laid, according to the nature or extent of the thoroughfare. Let us, for example, suppose, that a street measuring about thirty feet in breadth, be laid out in six compartments, as shown in the engraving, with a foot-path on each side. Three of these compartments are paved with ruble causeway for the horse-paths of the city or town. The remaining three for the highway, are represented as laid with broken stones. The sides of the stones, where they come in contact with each other, are to be dressed so as to form a plain joint across the track, and dressed square, so as to touch throughout the whole surface of the joint. The wheel track is to be flat, or without any groove, that carriages may move off and on without obstruction. The sides are to be dressed of the sloping form, shown in the section of the road, but, excepting in the joints across the track and on the top, the stones are only to be hammer-dressed or chipped after the usual manner. Great care will be necessary, as before noticed, in preparing a firm and compact foundation for the tracks. A stratum of gravel or stone chips, to the depth of three or four inches, laid in lime mortar, according to the nature of the soil, will answer in every case. The laying or building of street-stones with mortar, is common in Bath, Paris, and other cities; and unless such a plan be resorted to, the best effects of this system will be lost to the public.

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* In laying these stone tracks, they ought not to have been grooved. The portions grooved are much more worn than those which are not.

In upholding roads or streets of this description, the intermediate spaces, on which the horses go, will seldom require repair. We have seen, in the example of Leith Walk, that aisler causeway has continued in good order for about fifteen years, and, with occasional repairs, may probably last double that period. From this, we may conclude, that the tracks will continue for a period of many years. For, although the traffic upon them would be greater than upon the road or street generally, yet it is curious to observe, that however spacious a road may be, carriages are found to go very much in particular lines, one after another; and, therefore, the duration of aisler causeway forms a pretty good criterion for judging of the comparative economy of the proposed wheel-tracks.

With regard to the expense, we may notice, that, in the vicinity of Edinburgh, the lineal yard of two of these tracks will cost about nine shillings, and, consequently, double of this sum for two sets, to suit carriages travelling in opposite directions. In the ordinary traffic of a city or public road, they may be estimated to last about fifteen years, or as long as three or four strata of common road metal of 8 inches in thickness. Not only, therefore, will the comforts of the traveller and those around him be provided for, but the wear and tear of carriage-wheels be prevented, and the direct economy of upholding the highways and streets be carried to an immense extent by the adoption of this system. We are further of opinion, that this system of wheel-tracks is applicable in many situations, where iron railways would either be found too expensive, or where they cannot be introduced with propriety.

SEISMATIC MACHINE.

Gentlemen,—I have enclosed a drawing of a very simple machine for raising water, which, if you consider worthy of a place in your Magazine, you may introduce when convenient.

The first plan of this machine was a tube with a looped flexure, so formed, that by giving it a vibrating motion like the pendulum of a clock, water would ascend through it.—But it was afterwards found, that it would be a preferable plan to form it of a series of pipes terminating in corresponding boxes, as represented in the figure; and the model formed upon this plan was found to succeed quite well, both in raising water, and, when inverted, of forcing air down in water.

I do not anticipate that the instrument will be of much practical use; however, as I believe it is original, it may, on this account, gratify the curiosity of those of your readers who take pleasure in mechanical pursuits.

I have styled it "The Seismatic Machine," from a reference to its vibratory motions.

Yours, &c.

J. A.

POPULAR METHOD OF SOLVING QUESTIONS IN ASTRONOMY.

No. II.

Having in our last shown the method of finding the size of the earth, we shall now proceed to the method for finding the distance of the moon, after having described the form, and explained the use of the quadrant, which is an instrument used for ascertaining the heights and distances of objects.—It is the fourth part of a circular board, (as in fig 4.) the round edge of which is divided into 90 equal parts, called degrees, and having an index hand so fixed upon it at A, that it may turn and point to any part of the round edge. Upon the hand are fixed two little brass plates with a small hole in each to look through.

In measuring with the quadrant, the corner of it at A is always supposed to be in the centre of a circle. Suppose the circle in fig. 4 to be that in which the moon goes round the earth, and that the corner, A, of your quadrant is placed in its centre, and the corner at O pointing directly to M, where the moon is at the meridian, then, since all circles are divided into 360 degrees, we shall suppose the degrees of the moon's circle to begin at M, the moon's meridian, and go round by L and H, as in the figure.

The quadrant being placed as above directed, if the index hand be placed upon it so that, when the moon is at the meridian, she may be seen through the sight holes which are upon the index hand, it will then point to 0 degrees upon the quadrant, because the moon is then at the meridian, where we have supposed the degrees to begin.—But if the moon were at L, and the hand placed upon the quadrant so that she might be seen through the sight holes, then it would point to 60 degrees upon the quadrant, and, consequently, the moon would be 60 degrees from the meridian; and if she were down at the horizon at H, and the hand so placed that she might be seen through the sight holes, it would point to 90 degrees upon the quadrant, of course the moon is then 90 degrees from the meridian.

We shall now proceed to fig. 5, in which the large circle represents the moon's orbit or circle, E represents the earth, M the moon's meridian, and A, that place upon the earth at which we suppose the moon's distance to be measured.—When the moon is in the equinoctial, (that is, when the time she is above the horizon is equal to the time she is below it,) fix your quadrant so that the corner of it at O, may point directly to the moon when she is at the meridian; and the corner of it at 90, point exactly to that point of the horizon at which she sets. It is plain, that when the quadrant is fixed, if you place the index hand so that the moon may be seen through the sight holes when she is at the meridian, it will point to 0 degrees upon the quadrant, and when she comes to S, if you place the hand so as to see her through the sight holes, it will point to 90 degrees, by which it would appear, that the moon has gone round the fourth part of her circle, in going from M to S; but it is evident from the figure, that she cannot have gone round the fourth part of it till she goes to R, opposite the earth's centre, which is also the centre of her orbit. This is owing to the corner of the quadrant at A not being placed in the centre of the moon's circle, for if it were placed at the centre of the earth, the moon would be at R when the index hand pointed to 90 degrees, as may be seen by the figure.

It is well known that the moon takes 24 hours and 48 minutes to go once round the earth, from meridian to meridian; of course she will go round the fourth part of her circle (as from M to R) in the fourth part of that time, which is 6 hours and 12 minutes.

Having fixed your quadrant as above directed, note the exact time when the moon's centre is on the meridian, which we shall suppose to be six o'clock at night, then when she is drawing near to the horizon at S, watch her, and note the exact moment of time when you see her centre through the sight holes, when the hand is pointing directly to 90 degrees, which will be at 8 minutes and 4 seconds past twelve.* Thus you see she will have come from the meridian at M to S in 6 hours, 8 minutes, and 4 seconds, or moments, as they are commonly called, which leaves 3 minutes and 56 seconds that she will take to travel from S to R, which makes out the fourth part of her circle: then, since it is evident that the distance from S to R is equal to the half of the diameter of the earth, which is 3985 miles, (see the article in our last, p. 101,) and that the moon travels that distance in 3 minutes and 56 seconds; divide 89280, (the seconds which she takes to go once round her circle,) by 236, (the seconds she takes to go from S to R,) the quotient will be very near 378⅓, which is the number of times that she travels 3985 miles in going once round her circle. Therefore, multiply 3985, the miles, by 378⅓, the times that she travels that distance in going once round, and the product will be the number of miles that are in the circumference of her circle. Then divide the circumference by 3⅐ and the quotient will be its diameter, the half of which will be her distance from the centre of the earth.

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* "Here proper allowance" is "made for the refraction, which being about 34 minutes of a degree in the horizon, causes the moon's centre to appear 34 minutes above the horizon when her centre is really in it."

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\end{array}$$

$239854\frac{16}{22}$ miles is the distance of the moon from the centre of the earth.

REPORT

On the Manufacture of Gas obtained from Pit Coal, and on its relative value to Oil Gas. With some Remarks affecting the proposed Gas Establishment for the Town of Dundee.—By Mr. JOHN NEILSON, *Civil Engineer, Glasgow.*—Communicated by the Author.

[Continued from page 108.]

Relative Values of Oil and Coal Gas.

Having made these remarks on the subject of public prejudices in regard to gas establishments, we shall now, before entering on any recommendation with regard to the general structure or state of the works, state the result of some experiments made to ascertain the relative values of oil and coal gas, as these must have some influence in the decision of the question regarding what sort of gas lights you shall adopt.

The relative values of coal and oil gas, is a subject which was awhile ago agitated with some warmth, particularly in England, but I believe is now, beyond doubt, in regard to economy, set at rest in favour of coal gas, by means of the decisive experiments of Messrs. Heropath and Rootsey, of Bristol, which seem to have been conducted by them with great candour.

Several data of Messrs. Taylor and Martineau of London, the oil gas patentees, who seem to have been followed by Mr. Milne of Edinburgh, were, by their repeated experiments, proved to be erroneous. It had been stated by one of the parties, that an excess of 30 per cent. on the illuminating power of a gallon of oil, was gained by a process of decomposition in the patent apparatus; whereas it was found, by the experiments of Messrs. Heropath and Rootsey, mentioned above, that a diminution of 28 per cent. on the illuminating power of oil actually took place in going through that process.

Some statements, therefore, that were formerly given out to the public, such as that of 3 or 4 to 1, on the illuminating power in favour of oil gas, arising from the erroneous statement referred to, and other false data, were thereby dismissed as inaccurate, and it was proved that oil gas could not rate above $2\frac{1}{4}$ to 1, or more probably, under all circumstances, not above 2 to 1, compared with coal gas; so that, if a cubic foot of coal gas maintained a given quantity of light for an hour, the same bulk of oil gas would only maintain the same quantity of light for two hours, while the expense of manufacturing the one, by their own admission, amounts to about triple that of the other. The charge of manufacturing 1000 cubic feet of oil gas, was found to be, by the Hull Oil Gas Company, £1 6s. with oil at 2s. per gallon, and by trials in other hands, exclusive of interest on capital, £1 7s.; and 1000 cubic feet of coal gas, is at the same time rated in the statement alluded to, at 10s. exclusive also of interest on capital. But under the circumstances in which the Glasgow Company manufacture their gas, the whole expense of 1000 cubic feet, has been stated at 4s. 9d., exclusive of interest on capital; and the average selling price of that quantity to the community is 8s. 6d., being 1s. 6d. less on the selling price than the expense that the English coal gas was, in the comparison alluded to, calculated to cost. These calculations must no doubt be affected by local circumstances, and may vary accordingly.

The coal used by the Glasgow Gas Company, costs 16s. a ton of 20 cwt., and the quantity of dross used for carbonizing that weight, may cost about one-fourth of its value; thus making the amount of the gas and furnace coal to cost about 20s. a ton. There may be other circumstances than these in the structure and general arrangement of the Glasgow Works, which enable them to manufacture their gas at a price I believe unprecedentedly low. But in a coal country where the means of conveyance are so easy, it is not at all likely that oil can ever come into a successful competition with that of coal.

Two hundred pounds of Lesmahago coal will produce 1080 cubic feet of gas, allowing 4½ cubic feet of gas to each pound of coal, which is rather below than above the quantity, and can be had, including coal for carbonizing, for 2s.; whereas ten gallons of cod oil cost, according to the London statement, about 20s., and will not give above 1000 cubic feet, some experiments making it considerably under this; while it does not possess above twice the illuminating power of good coal gas. Under these circumstances in the raw material, even making most liberal allowances for tear and wear, and for expenses of labour in favour of oil gas; yet the same quantity of this light will still be about one-half more expensive than the other. It is also unfortunate in regard to any prospective view of making oil gas a profitable manufactory; that of the three only towns in England which have lighted with oil gas, one of these (Colchester) after some-time mixing the gases, has given up the oil, and has had recourse entirely to coal. Norwich has been lighted about 4 years, and has only lately paid a small dividend. Hull is but lately lighted, and, as yet, of its progress or success I have not seen or heard any account.

The advocates of the oil gas system have also stated that it has no offensive smell, and that it does not emit smoke as the coal gas does when allowed to escape. These notions, however, are unfounded. On this subject, the following quotation from a letter addressed by a Mr. John Howe (of Dublin, I think,) to Messrs. Taylor and Martineau of London, is something amusing, as well as confirmatory of the assertion I have made:—

"A most respectable solicitor, residing in the house, No. 48, Upper Sackville-Street, Dublin, found his habitation invaded by a most distressing stench, which for two days acted as an emetic on the members of his family. As the gas of both companies ran by his door, and the pipes of the oil gas company had been but recently laid, he naturally suspected the cause of his uncomfortable situation, and sent a complaint to the office of that company. Workmen were sent, some leaks were discovered and stopped, but still the stench continued. He therefore sent to the coal gas company, and threatened an action at law for the nuisance. The engineer of that company attended. He immediately perceived that the smell was that of oil gas, but proceeded to lay bare his mains for the satisfaction of all concerned. He found them all perfect, but as the pipes were close together, he discovered another issue of oil gas, which, when ignited, afforded an immense blaze. This being stopped, the nuisance ceased."

An oil gas establishment, however, has some conveniences; its apparatus is simple, and vessels of half the dimensions for making and distributing coal gas, will contain the same quantity of illuminating power, and may be established about one-third cheaper in the first instance, and consequently the after tear and wear ought to be nearly in the same degree diminished.

In the event, however, of establishing any new concern for the manufacture of gas, where coal can be had at a moderate rate, I am of opinion that it would be extremely imprudent, with any view to profit, to construct an apparatus for oil gas alone. The establishment, however, might be so constructed that a small appendix on the oil gas system might be joined to the works, having a gasometer and meter of its own, to ascertain the produce derived from that branch, in the way of experiment. And, in this way we might, at a small expense, arrive at a practical conclusion of the propriety of discontinuing, or of extending and carrying on this, as a whole, or as a part of the establishment.

Should you, therefore, enter into these views of this subject, it will be necessary that the site of your works, the greater part of the retorts, the gas-holders, the conveying pipes, the condenser, purifier, and several other parts of the proposed establishment, be constructed to suit in the first instance, for manufacturing gas from pit coal. I shall therefore keep this in view in what further observations I may have to make.

Site of a Coal Gas Establishment.

There does not in general seem to be any real necessity arising from the process of making gas, or from the distribution of it, why we should choose a lower part of the town, rather than one more elevated. Nevertheless, from the general lay of the town of Dundee, I should in this case prefer a low one, and would recommend that it be obtained near the shore of the river. Besides the convenience of finding coal, the chief article of consumption at a cheap rate, and getting easier clear of the rubbish which soon accummulates about such an establishment, in consequence of its low situation, it would tend to simplify the general arrangement of the works. The circumstance of the streets being in general subject to no great elevation above each other is also favourable to this. To equalize the pressure of gas, it is sometimes necessary to distribute gas-holders in different parts, and at great distances from the establishment. But in this case (if we except the Bonnet Hill) the streets being subject to no great elevation, this might be avoided, and we should thereby diminish the labour of conducting the works—the gas-holders, &c. being under the eye of the manager, and enclosed in the walls of the primary establishment; hereby, also, we should give less offence to the community, than if we were obliged to fit up gas-holders in several parts of the town.

To counteract the additional pressure which the gas would maintain in the higher levels, it might be necessary in some cases to introduce a few regulating cocks for that purpose, should the distance of the distributing pipes from the point of supply not of itself form a sufficient re-action.

The property of Mr. Gray, in the neighbourhood of Peep o' Day, has, besides the several advantages alluded to, a small stream of water, which could be used with advantage to give motion to a gas purifying apparatus, and some other conveniences necessary about the works. From this situation, however, to Baxter's spinning mill, there would be about three hundred yards of sleeping main to set off, against its local advantages, in consequence of no supply of gas being wanted for that extent towards the town.

Should the consumption of gas increase to 10,000 jets, (each of these of three inch flame, being reckoned equal in illuminating power to a candle and a half of six in the pound,) the main, in this case, could not be less than 9 inches diameter; and 300 yards, including laying and jointing the pipes, and cutting and making up the surface, would cost nearly £300. But this sum, could the ground be got at an easy rate, would be a small consideration, compared to the daily expense that would be incurred in cartage of coal and other materials, should the works be in any part of the town distant from the shore, and in clearing the works of the ashes and other rubbush that accumulate.

If we suppose a consumption of gas equal to 5000 jets, the quantity of gas coal, and coal for carbonizing to keep up this supply, might be reckoned at nearly $3\frac{1}{2}$ tons a day, and a proportional increase according to the consumption; and in some situations we might even be obliged to cart off several of the products of the works to some distance, as is the case at the works in Glasgow. We should reckon, therefore, on a saving of at least £50 a year on such a site, in preference to one at a distance from the shore.

The plot on the west of Mr. Straton's Foundery, possesses every advantage that could be wished in respect of water, proximity to the town and to the sea beach, and would otherwise suit, could a sufficient quantity of ground be obtained.

The westward, in the vicinity of Mr. Carmichael's property, has several advantages. There is a sufficient quantity of ground; and from the trial we made in the surface, it is suitable for the buildings. It has also a plentiful supply of water to give motion to any apparatus that would be necessary for the works. The main would, also, at a very small distance from the establishment, branch off to the neighbouring spinning factories considerable quantities of gas. But it has all the disadvantages attending the daily expense of cartage to and from the works. I am not aware that any deposit for the rubbish can be had in that neighbourhood.

The works in England vary considerably in the quantity of ground they occupy. The extent being from half an acre, to two acres and a half; but some of them must be greatly cramped by want of room. It is remarkable, that, in Manchester, where there are 55 retorts and 7 gas-holders, that the works should occupy only half an acre of ground. Wigan has 12 retorts fitted up on the oven plan, 2 gas-holders, and 1½ acres. The necessity of storing a supply of coal within the works, makes a larger portion of ground necessary than might otherwise answer every purpose requisite, and although a situation on the beach has conveniences which one more inland is deprived of, yet it would not be advisable for you to have less than an acre, even under the most favourable circumstances that can be contemplated.

ON THE CRANK.

Gentlemen,—I feel obliged to your Correspondent, W. C. (p. 94, Vol. III.) for showing that the crank is not inferior in power to the rack and pinion, when employed to convert reciprocating into rotatory motion. I had entertained similar ideas on that subject with your other Correspondent, A. B., and last year constructed a model with double wheels, having a rack on each side of them, connected directly from the piston-rod. It works remarkably well, turning the fly wheel with a uniform motion, and making two revolutions by the double stroke. I thought it original, but soon found it was not, and now find that there is no power gained, for had the diameter of these wheels been equal to the diameter of a crank, the same length of stroke for that crank would not cause them to make a revolution, but less than two-thirds of one. The double stroke required for a crank is twice its diameter, and that for a wheel and rack, the whole circumference; they will, therefore, be as 2. to 3.1416 in favour of the crank at its most effective points, and this will be about equal at its average leverage.

Suppose the length of stroke to be 3.1416; a crank for this will be 1.57, whose average lever I suppose to be 1.; diameter of wheels to make one revolution must be 2.; the radius or lever of which is 1. also; therefore, equal.

I prefer this mode of taking a single stroke, or half a revolution, for being simpler, and making a ready reference to the crank, as some of your readers may find a difficulty at seeing 1.91 stated as the average leverage of a crank whose whole length they know cannot exceed 1.5. If you think this more familiar statement will tend to solve that difficulty to any of your readers, its insertion will oblige,

Yours, &c.

E. C.

Glasgow, 24th March, 1825.

LETTERS AND QUERIES.

LANARK MECHANICS' INSTITUTION.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,— Observing in your Magazine of the 12th instant, a small paragraph about the formation of a Mechanics' Institution at Rotherham, I take the liberty of requesting that you would insert a similar paragraph regarding the "Lanark Mechanics' Institution."

Their first meeting took place on the 19th February, and was but thinly attended: they meet every Saturday evening betwixt the hours of eight and ten. They have already purchased about 30 volumes, mostly history, and I understand they are in expectation of a set of regulations from the Glasgow Gas Work, which they made application for through the medium of your Publisher.

In hopes that you will make the thing public through your valuable Magazine, and wishing you much success, I remain,

Yours, &c.

G. J. R.

Lanark, 23d March, 1825.

ANSWER TO PUMP QUERY.

Gentlemen,—In answer to A. B.'s (near Glasgow) question respecting a pile of pumps, I would say that it will be no greater burden to the engine although the pumps were 10 feet diameter.

O.

March 15th 1825.

[Our Correspondent, in answering this query, might have been more explicit than he has been, and should have stated the reason for his opinion. It is perfectly evident, that the diameter of the pile of pumps can have no effect on the engine, as it does not add to the weight in the working barrel. The burden on the engine depends entirely on the diameter of the working barrel, and the perpendicular height of the pile of pumps. As we have answered A. B.'s question, and as we really do not see what benefit can be obtained by setting up a pile of pumps such as his query mentions, we shall be obliged by his answering as the following query:—Would a pile of pumps, 18 inches diameter, with a 10 inch working barrel and a given stroke, deliver more water than another pile 10½ inches diameter, with a 10 inch working barrel, and the same given stroke? By answering this question, A. B. will easily satisfy himself of the burden the engine will have in both cases. We should likewise wish to have his opinion as to the cause of making the pile of pumps larger than the working barrel.]

QUERIES.

Gentlemen,—A friend in the country begs a solution of the following queries through the medium of your valuable Magazine, which I hereby submit to the investigation of your numerous and learned readers.

1st. What is the true ratio between motion and power?

2d. When a solid body turns round, does the centre move or not?

3d. How high must a tower be when you lose the level from the sea?

I am, yours, &c.

E. S.

Glasgow, 16th March, 1825.

Gentlemen,—In reading over your Number of the 19th instant, I was surprised to see a letter from "A Weaver," stating "that webs might be dressed in the act of warping, and given to the weavers on tin beams." As I do not see any mode of doing it, if your Correspondent would favour me with his mode, it would oblige,

Yours, &c.

V.

Glasgow, 24th March, 1825.

Gentlemen,—Can any of your numerous Correspondents inform me what will take linseed oil out of paper, and greatly oblige

A Reader?

[Our Reader will find an answer to this query, by referring to page 285, Vol. II. of our Magazine.]

Gentlemen,—Could any of your Correspondents inform me the best binding for books going to the East Indies, or any other hot climate?

By attending to the above, you would greatly oblige

Liber.

Glasgow, 19th March, 1825.

USEFUL RECEIPTS.

Bugs destroyed by Steam.—Steam is said to be an effectual means of destroying this noxious insect. It is only requisite to expose the place where they *herd for* a short time to the action of steam, and the more the water boils the better; it kills the eggs, as well as the vermin. The employment of this method is both so convenient and so cleanly, that we think we need say nothing of the mode of applying it, nor by way of recommending it to trial.

For preserving Iron and Steel from rusting.—Mix with fat oil varnish, a half at least, or rather four-fifths, of well rectified spirit of turpentine. This varnish is applied slightly and in an equal manner, by means of a sponge, after which the article is suffered to dry in a place sheltered from dust. Articles varnished in this manner will retain their metallic brilliancy, and never contract any rust. This varnish may be applied also to copper, of which it preserves the polish, and brightens the colour. It may be employed in particular, with advantage for preserving from alteration, Philosophical Instruments, which, in the course of experiments, are brought in contact with water, and by these means, lose their splendour and become tarnished.

Universal Cement.—A cement made in the following manner will unite, it is said, either glass or procelain, and either marble or metals:—

To an ounce of mastic, add as much highly rectified spirit of wine as will dissolve it. Soak an ounce of isinglass in water until quite soft, then dissolve it in pure rum or brandy until it forms a strong glue, to which add about a quarter of an ounce of gum amoniac, well rubbed and mixed. Put the two mixtures together in an earthen vessel over a gentle heat; when well united, the mixture may be put into a phial and kept well stopped.

When wanted for use, the bottle must be set in warm water, when the china or glass articles must be also warmed, and the cement applied. It will be proper that the broken surfaces, when carefully fitted, be kept in close contact for twelve hours at least, until the cement is fully set; after which the fracture will be found as secure as any part of the vessel, and scarcely perceptible.

To gild Silk or Ivory by the action of Hydrogen Gas.—Immerse a piece of white satin, silk, or ivory, in a solution of nitro-muriate of gold, (in the proportion of *one part* of the nitro-muriate to three of distilled water.) Whilst the substance to be gilded is still wet, immerse it in a jar of hydrogen gas, and it will soon be covered by a complete surface of gold.

REMARK.—The divisibility of gold by precipitation in this manner is astonishing, for the coating is hardly the ten-millionth part of an inch thick.

This experiment may be very beautifully and advantageously varied as follows: Paint flowers or other ornaments with a very fine camel hair pencil, dipped in the solution of gold, before mentioned, on pieces of silk, satin, or ivory, and hold them over a Florence flask, from which hydrogen gas is evolved during the decomposition of water by sulphuric acid and iron filings. The painted flowers or other devices will, in a few minutes, shine with all the splendour of the purest gold. A coating of this description will not tarnish upon exposure to the air, or in washing.

REMARKS.—Porcelain is gilded by mixing nitro-muriate of gold, gum water, and pulverised borax. The mixture is laid on by a brush, and the porcelain is burned in an oven. The gold is thus revived with great splendour. Porcelain and other wares may be plantinized, silver-edge tinned, and bronzed, in a similar manner.

To make liquid Gold and Silver for Vellum, Painting, Fans, &c.—Grind up gold or silver leaf with gum-water or honey in a mortar, then wash away the gum or honey that remains, and use the powder that remains with gum-water.

This may be applied to any article with a camel's hair pencil, in the same way as any other colour.

To make Names grow in Fruit.—When fruit is about half ripe, cover the side exposed to the sun with stripes or specks of wax, in any desired shape or form, which hinders the sun from colouring the parts covered, and when the fruit is ripe and the wax removed, it will be found marked in the manner desired.

To make White Lead.—Dissolve litharge in weak nitric acid, precipitate this solution with prepared chalk, the precipitate washed and dried affords a ceruse of the whiteness of snow.

Method of destroying Insects and Blights in Fruit Trees.—Wherever you see a branch of a tree either blighted or eaten by insects, take a shoemaker's awl and pierce the lower part of the branch into the wood, then pour in a drop or two of quicksilver, and stop the hole with a small piece of wood. In a day or two all the insects, not only upon that branch, but upon the rest of the branches, will fall and die, and the blights will cease.

To tin Iron Plates.—After the plates are reduced to a proper thickness, let them be immersed in water acidulated with sulphuric or muriatic acid, in order to cleanse them completely from rust.—They are then rubbed quite bright, and placed in a pot or other convenient vessel filled with melted tin, the surface of which is covered with suet, pitch, or rosin, to prevent it from being oxidated. The plates of iron being passed through, the tin will unite with them, so as to cover each side of the plate with a thin coat of tin, they are then called tin plates. In the same way stirrups, buckles, bridle-bits, &c. are covered with a coat of tin.

MISCELLANIES.

Form of Hailstones.—Whilst ascending the volcano of Porace, in the Andes, M. Humboldt had occasion to observe, that, during a hail-storm, the hailstones, which were white, from five to seven lines in diameter, and formed of different translucency, were not merely very much flattened at the poles, but were so much swelled in their equatorial dimensions, as to have rings of ice separate from them on the slightest blow. M. Humboldt had twice previously observed this phenomenon in the mountains of Bareuth, and near Cracow, during a journey in Poland. "May it be admitted, that the successive layers, which are added to the central nucleus, are in a state of fluidity sufficient to allow of the flattening of the spheroids being caused by a rotatory movement?"—*Ann. de Chim.* xxvii. 120.

Proposed Mechanics' Institution at Huddersfield.—A Correspondent at Huddersfield, whose communication we cannot insert at length, strongly recommends the establishment of an institution in that town for the instruction of the working classes; and, in addition to the great general advantages resulting from these institutions, in ameliorating the character of the population, he urges that Huddersfield is particularly interested in improving the skill and science of its operatives, by the powerful and daily increasing rivalship of Leeds in its manufacture. We trust some of the public-spirited inhabitants of that town will act upon this useful suggestion.—*Leeds Mercury.*

Richmond Mechanics' Institute.—Institutions for the instruction of the working classes are springing up so fast around us, that we are called upon almost weekly to perform the pleasing duty of announcing some new establishment. This week we have to record the formation of a Mechanics' Institute at Richmond, in the North Riding, under the patronage of Lord Dundas and John Hutton, Esq. of Marske, the High Sheriff of the county. A number of individuals in the town, friendly to the instruction and improvement of the working classes, having associated themselves for the formation of a society, and the number having subsequently increased to nearly fifty persons, a general meeting was held on Monday, 28th February, at which a series of resolutions were passed forming the outline of an Institution. Richmond having no manufactures, it was determined to confine the project, in the first instance, to a library, comprising works of science and general literature, and a reading-room: the annual subscription was fixed at 8s.; and the officers are to be chosen by and from the subscribers at large, without any distinction. The Institution is thus established on a basis which cannot fail, and we wish it as much prosperity as, from its excellent object, it deserves.—*Ib.*

NOTICES TO CORRESPONDENTS.

G. M.—Dixon Vallance.—U. S. C.—C. B.—have been received.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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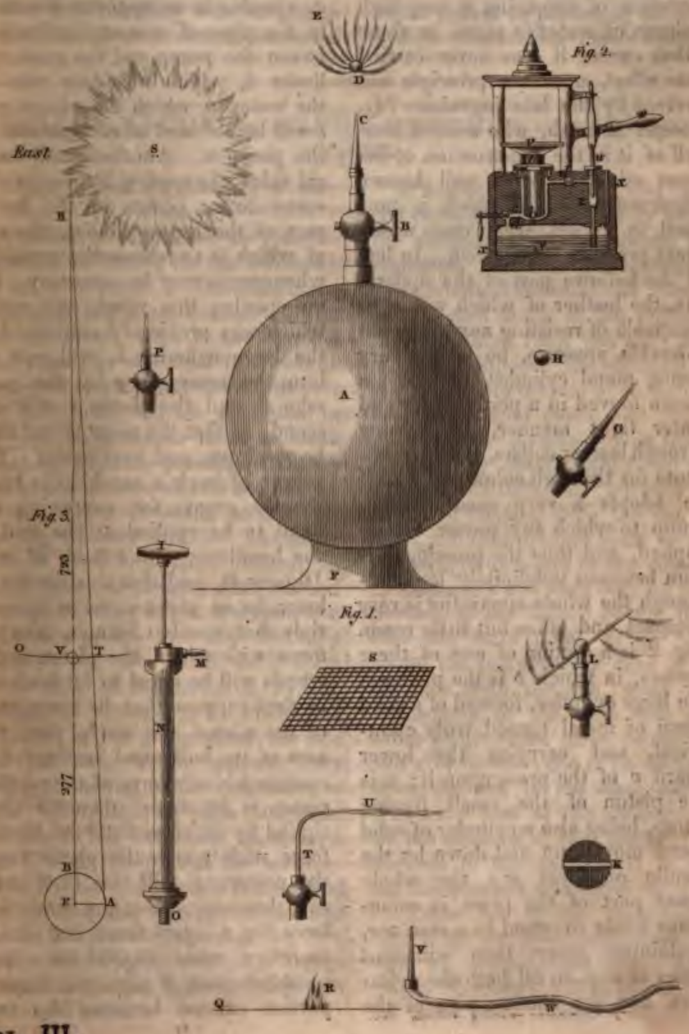
MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

"An idler is a watch that wants both hands;
As useless when it goes as when it stands."

No. LXVII. *Saturday, 9th April, 1825.* Price 3*d*.

BRAMAH'S PRESS, &c.



Vol. III.

Swan Sc

BRAMAH'S PRESS.

It is astonishing that so extensive a power, and one which is so easily obtained, as that derived from the pressure of water, should not have been applied to many useful purposes ages ago. Such an application was indeed hinted at by Pascal in the middle of the 17th century, but from the inconvenience of managing a very high column of water in pipes, or some other cause, it was never carried into effect, until the principle was revived by the late ingenious Mr. Joseph Bramah, who availed himself of it in the construction of his most admirable and well known *Hydraulic Press*, which is now used in almost every case where great pressure is required. In lieu of the bellows part of the apparatus, the leather of which would be incapable of resisting any very considerable pressure, he used a very strong metal cylinder, in which a piston moved in a perfectly air and water tight manner, by passing through leather collars, and as a subtitute for the high column of water, he adopts a very small forcing pump to which any power can be applied, and thus the pressing column becomes indefinitely long, although the whole apparatus is very compact and takes but little room. Fig. 2 is a section of one of these presses, in which t is the piston of the large cylinder, formed of a solid piece of metal turned truly cylindrical, and carrying the lower board v of the press upon it: u is the piston of the small forcing pump, being also a cylinder of solid metal moved up and down by the handle or lever w; the whole lower part of the press is sometimes made to stand in a case $x\,x$, containing more than sufficient water as at y, to fill both the cylinders, and the suction pipe of the forcing pump u dipping into this water will be constantly supplied. Whenever therefore the handle w is moved upwards, the water will rise through the conical metal valve z, opening upwards into the bottom of the pump u, and when the handle is depressed that water will be forced through another similar valve a, opening in an opposite direction in the pipe of communication between the pump and the great cylinder b, which will now receive the water by which the piston rod t will be elevated at each stroke of the pump u. Another small conical valve c is applied by means of a screw to an orifice in the lower part of the large cylinder, the use of which is to release the pressure whenever it may be necessary; for on opening this valve, any water which was previously contained in the large cylinder b, will run off into the reservoir y by the passage d, and the piston t will descend, so that the same water may be used over and over again. The power of such a machine is enormously great; for, supposing the hand to be applied at the end of the handle w, with a force of only 10 pounds, and that this handle or lever be so constructed as to multiply that force but 5 times, then the force with which the piston u descends will be equal to 50 lbs.: let us next suppose that the magnitude of the piston t is such, that the area of its horizontal section shall contain a similar area of the smaller piston u 50 times, then 50 multiplied by 50 gives 2500 lbs. for the force with which the piston t and the presser v will rise. A man can, however, exert ten times this force for a short time, and could therefore raise 25,000 lbs., and would do more if a greater disproportion existed between the two pistons *t* and *u*, and the lever *w* were made more favourable to the exertion of his strength.

This machine not only acts as a press, but is capable of many other useful applications, such as a jack for raising heavy loads, or even buildings; to the purpose of drawing up trees by their roots, or the piles used in bridge building; and until the experiments of Mr. Perkins, this machine was thought to offer the clearest demonstration of the utter incompressibility of water. It does not however appear, that any correct experiments have ever been made to ascertain whether the rise of the large piston *t* was in exact proportion to the quantity of water thrown in by the pump. It is probable this is not the case, and that the water does suffer a slight compression, although its elasticity is so small as to have hitherto escaped notice, as producing no practical or even visible inconvenience.

POPULAR METHOD OF SOLVING QUESTIONS IN ASTRONOMY.

No. III.

How to find the distance of the Sun.

WE shall now proceed to give the method of finding the sun's distance from the earth. This might be found in the same manner as that of the moon, were it not that the difference of the time in which he appears to go round the fourth part of his circle, and the true time in which he performs it, is so small that it is hardly perceptible, being only about one-half of a moment of time, which is owing to his immense distance from us. Astronomers, therefore, were obliged to have recourse to some other method by which they might ascertain the distance of the sun, and the only eligible one they could think upon was that of measuring it by the transit of Venus over the sun's disk; that is, by her going across the face of the sun, which happens very seldom, owing to the inclination of her orbit, or, in plain language, owing to her orbit not being on a level with the orbit of the earth.—We shall try to explain this method of finding the distance of the sun in as simple a manner as we can, after having premised a few things necessary to be known before you proceed to it.

It has been discovered that there is a certain immutable law by which the motions of all the planets are regulated, *viz.* that the squares of the periodical times of the planets are to each other as the cubes of their distances from the sun; that is, if we suppose the distance of the earth from the sun to be divided into 1000 equal parts, and multiply the time it takes to go round the sun by itself, (which is the square of its time,) and multiply its supposed distance from the sun by itself, and that product again by the distance, (which will be the cube of its distance,) and then say, by proportion, if the square of the time that the earth takes to go once round the sun give the cube of its distance from the sun, what will the square of the time that any other planet takes to go round the sun give for the cube of its distance from the sun in the same parts? The cube root of the answer will be the distance of that planet from the sun in the same parts as the earth's distance was taken in.

From this it has been found, that if the earth's distance from the sun be divided into 1000 equal parts, Mercury's will be about 387 of these parts, Venus' 723, Mars'

1523, Jupiter's 5201, &c. From this it is evident, that if once the real distance of any one of the planets were found, the real distances of the rest might be easily found from the above numbers.

We shall now proceed to figure 3d, in which S represents the sun. The curved line, O, V, T, a part of Venus' orbit; V, Venus; and E, the earth. Let us suppose that there are two persons placed upon different parts of the earth to observe the transit; one at B, where the east or left edge of the sun is exactly on the meridian, and another at A, 90 degrees west from the one at B. When it is one minute past twelve o'clock, P. M. at B, it will be one minute past six o'clock, A. M. at A, owing to the difference of their meridians. It is evident from the figure, that the person at B will see Venus on the sun's face before she is seen on his face by the person at A; because, when Venus is at V, she is in a straight line between the person at B, and the east edge of the sun at R: but she cannot be seen within the sun's edge by the person at A, till she goes from V to T in her orbit; because she does not come in a straight line between him and the edge of the sun till then—of course she will just be the time that she takes to go from V to T, in her orbit, later in being seen on the sun's edge by the person at A, than by the one at B. Now, we shall suppose that the person at B saw her exactly within the edge of the sun at R, at a minute past twelve o'clock P. M., but that the person at A did not see her come within his edge till 6 minutes and $38\frac{3}{5}$ seconds past six o'clock, A. M., which would be the case. They would thus find that she would be 5 minutes and $38\frac{3}{5}$ seconds later in being seen on the sun's face by the person at A, than by the one at B, which is the time that she takes to go from V to T in her orbit.

From the tables that have been calculated for showing the quickness with which Venus would cross the sun's face at that time, it appears that she would move 4 seconds of a degree in a minute of time; consequently, she would move $22\frac{5}{9}$ seconds of a degree in 5 minutes and $38\frac{3}{5}$ seconds of time; then, since the distance from the centre of the earth to A is greater than the distance from V to T, say, by proportion, if 723, the relative distance from the sun to Venus, give $22\frac{5}{9}$ seconds of a degree, what will 1000, the relative distance of the earth from the sun, give? The answer will be $31\frac{1}{5}$ seconds of a degree, nearly, which is the distance from A to the centre of the earth.

$$
\begin{array}{l}
723 : 22\frac{5}{9} :: 1000 \\
\quad\quad\;\; 1000 \\
723)\overline{22555}(31\frac{142}{723} \text{ or } 31\frac{1}{5} \text{ nearly.} \\
\quad\;\; 2169 \\
\quad\quad \overline{\;865} \\
\quad\quad\;\; 723 \\
\quad\quad \overline{\;142}
\end{array}
$$

Let us now suppose a circle to be drawn round Venus, with the circumference going through the centre of the earth, (fig. 3.) then since the distance from A to the centre of the earth is $31\frac{1}{5}$ seconds of a degree, and that distance is known to be 3985 miles, divide the seconds that are in 360 degrees by $31\frac{1}{5}$, and it will give you the number of times that there are 3985 miles in the circumference of that circle. Multiply the times by the miles, and it will give you the miles that are in the circumference of it. Divide the miles in the circumference by $3\frac{1}{7}$, and the quotient will be the diameter of the circle, the half of which will be the real dis-

[illegible]nce of Venus from the earth, when they are in conjunction; that is, when they are in the nearest parts of their orbits to each other.

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           5         5
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        156)6480000(41538 72/156 = 41538 18/39
              624
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  3 1/7)165530769
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  22)1158715383(52668881 ÷ 2 = 26334440½ = the miles
     110              in the half of the diameter of the circle,
     ───              which is Venus' distance from the earth,
      58              (fig. 3.)
      44
      ───
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       ───
        195
        176
        ───
         193
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          178
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            23
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             1
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Now, since it has been shown that if the distance from the earth to the sun be divided into 1000 equal parts, Venus' distance from him will be 723 of those parts.—Subtract 723 from 1000 and the difference will be the relative distance of Venus from the earth, when they are in conjunction.

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1000
 723
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 277
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Then say, by proportion, if 277, her relative distance, give $26334440\frac{1}{2}$ miles for her real distance from the earth, what will 1000, the relative distance of the earth from the sun give, for the real distance of the earth from the sun? The answer (95070110) is the number of miles in the distance of the sun from the earth.

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277 : 26334440½ : : 1000
                    1000
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    2493                 the sun.
     1404
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        505
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         280
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          30
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REPORT

On the Manufacture of Gas obtained from Pit Coal, and on its relative value to Oil Gas. With some Remarks affecting the proposed Gas Establishment for the Town of Dundee.—By Mr. John Neilson, *Civil Engineer, Glasgow.*—Communicated by the Author.

[Continued from page 125.]

On the form and materials of Coal Gas Retorts.

The next subject of consideration respects the retorts; and, in connection with this, the method of fitting them up in furnaces for carbonizing the gas coal. The structure of the house, also, in which they should be placed, is of some importance for the prosperity of the works.

On the strength and quality of the material used in the composition and form of the retorts, there has been a variety of opinion. It is on this branch of the establishment, both as regards the retort and method of heating, that a great expense by tear and wear, and consumption of fuel, is incurred. Accordingly, much has been done in England, by experiment, to arrive at the best possible means of diminishing this expense.

Perhaps, after all that has been done, it will be impossible to arrive at a form of retort or of furnace which will suit every situation.—The kind of coal used for decomposition, as well as for carbonizing, must in some degree regulate this. If parrot or candle coal is used, the most suitable retort would be one of an oval shape, and to contain about 150 lb. of coal; and by a late improvement of the furnaces here, two of these could be heated with nearly the same quantity of fuel that was formerly consumed in heating one: on the other hand, if Newcastle coal, or coal similar in quality, (such as Lord Elgin's,) is used, retorts of a smaller size, and something of a form more rounded at the extremes, might be tried; as, owing to the increase of the coke in bulk, beyond the coal in its raw state, more clearance is necessary in the upper part of the retort than with parrot coal. These might be fitted up in ovens of three or more, as is the practice in Carlisle and other towns in England. But I have no reason to think that either these or others of a cylindrical form, are equal in effect to an oval retort, provided a little more rise be given on the upper side of the retort, to provide for the expansion of the coal alluded to.

A very material objection arises against circular retorts, from the diminution of heated surface applied to the coal; the consequence of which is, that the gas is given out in a protracted state, and the quantity thereby greatly diminished, besides the increase of furnace coal which is consumed in keeping up the heat for six or eight, instead of four hours.

An attempt has been made, and lately with some success, at Birmingham, to introduce fire clay retorts instead of cast iron, which has hitherto, (if we except Liverpool,) been the only material used. In Liverpool, they are made of mallable iron. But although Mr. King, the Engineer, introduced these, and is fondly attached to them, yet they do not seem to be more economical, if even so much so, as those composed of cast iron. And although it is stated that one of the fire-clay retorts has gone for twelve months, and is still in good order, yet there is not so much experience of this sort of retorts, as to lead us to conclude that they shall ultimately supersede those made of cast iron. The most convenient and economical method of building up retorts, is that of a double bench, formed in a rectilinear line, having all the furnaces on one side of the house. The form of the retort-house must be regulated by the form of the benches, and may be formed on cast iron, to be open on all sides, and to be covered in with a ventilator and cast iron roof, to prevent any chance of conflagration by the discharge of flame which occurs in drawing and charging the retorts.

Should you adopt such a retort as would contain a charge of 150 lb. of good coal, this would produce at least 600 cubic feet of gas, and in six charges during twenty-four hours, giving four hours to a charge, would give 3600 feet. The consumption of gas for 5000 jets, on an average of five hours' burning, allowing a cubic foot to maintain a jet for an hour, would be 25,000 cubic feet a day, which would require seven retorts working night and day to supply that consumption; and if it should be increased to 10,000 jets, double that number would be necessary, besides a few spare ones for supplying tear and wear.

In the first instance, therefore, the establishment might be put in operation with ten or twelve retorts, but with a prospective view of increasing the number to twenty or upwards.

On the form and position of the Hydraulic Main.

The hydraulic main and dip pipes, leading from the retorts, deserve particular attention, owing to the obstructions that have occurred here, and the changes that have been made in their construction.—These parts serve as a conduct, and as first reservoir, into which the gas, tar, and other substances are collected, whence they pass into the tar vault, with which the main is joined. These, as well as other parts of the apparatus, have undergone various alterations and improvements. The present form of the hydraulic, in its most improved state, is that of a semicircular pipe, having covers or doors that can be removed at pleasure, and to which the pipes from the retorts are connected. This main contains a quantity of tar, into which the pipes from the retorts immerse a few inches. The tar thereby acts as a valve to prevent the return of gas into the retorts while in the act of charging. Formerly, the main consisted of a square chest for each retort, placed below, which received the dip-pipes in the same manner as the others, with pipes communicating between each chest; but from its near situation to the retort, the tar being continually impregnated with hot gas, hardened into pitch, and choaked up the passage. From the difficulty of removing these obstructions, and the danger attending them, this sort of hydraulic main has been given up, and the form referred to substituted in its stead.

From these difficulties, and other considerations of convenience, the hydraulic main in the several works in England, as well as in the works here, is now elevated a few feet above the range of the retorts, so that the gas, instead of a downward direction which it formerly took, ascends into this as a reservoir, by means of which the tar, in a state of vapour, is longer detained in the retort; and, in a considerable degree, (compared to what took place formerly,) is decomposed into gas. In the alteration of the construction of the works here of late, as well as in those lately fitted up by me at Kilmarnock, we have not only taken advantage of this vertical elevation of the hydraulic, but have also, by the peculiar construction of the roof, set off the hydraulic at eight or ten feet distance from the retort, in a horizontal direction, by means of which its connection with the retort is at a distance of about sixteen feet. The union pipes, forming in one line a vertical direction, and in the other a line inclining upwards to the hydraulic, into which they dip. By this lengthened elevated line, the tar in a considerable degree deposits itself, and returns to the retort to be decomposed anew. This mode of arrangement in the fitting up of the hydraulic, has also the advantage of a free circulation of the surrounding air, by which means it forms in some degree a refrigatory for cooling the gas, and thereby depositing several heterogenous particles of tar and ammonia that were still held in a state of vapour. It has also the convenience of being easily got at, to remove any obstruction that may generate in this part of the apparatus.

On Coal Gas purifying vessels.

The tar vault, particularly the condenser and purifiers, will not admit (I am afraid) of such a description as to give you any clear idea of them without accompanying drawings. We may, nevertheless, state, that all of them may take the name of large cisterns, modified under different forms, through which the gas passes in a slow and circuitous manner, until it arrives at the discharge from the last lime purifier, and thence is conducted to the gas-holders by a pipe communicating therewith.

Many alterations have, at different times, been made in the structure of lime vessels for purifying coal gas; and until lately it does not appear, that any form was hit upon sufficiently powerful to separate entirely the sulphuretted hydrogen. This is now effected. The gas at present made in the Glasgow Gas Works seem to be entirely free of it, and will not tinge either silver or gilding. Nor can the acetate of lead, which is reckoned a very delicate test, discover in it any of this offensive mixture. On this subject of purity, therefore, this gas, under strict attention and management, may now stand a comparison with that obtained from oil.

Gas-holders.

There is little difference in the form of gas-holders hitherto made, having been either square, oblong, or cylindrical. This latter form I should think preferable to the others. It is easily suspended, combines the greatest strength in its structure, and presents a form suitable for making a circular tank, which, in regard to strength, is much preferable to a square one.

Gas-holders have mostly hitherto been framed of cast iron, with wood and thin mallable iron; but in England, I understand, and some I have lately made, are much simplified in their construction, being almost framed of angle iron and thin sheet plate, by which there is a considerable saving in the weight and general structure of this part of the erections.

Two gas-holders would be necessary for the proposed establishment, and the dimensions may vary as the circumstances will admit, from 30 to 36 feet diameter, and from 16 to 18 feet deep. Those gas-holders, if constructed of sufficient strength, of the larger form, may weigh about 6½ tons, and would cost each about £280, exclusive of suspension geering.

Until you determine on a site for the works, we cannot fix on what method would be most suitable to advise for the purpose of admitting and delivering the gas to and from the gasometers, nor on any fixed method for the general arrangement or structure of the works, as this must in some degree be regulated by local circumstances. We shall, therefore, only make a few observations farther on the mains for the street, and on the distributing pipes and stop valves necessary for conducting and distributing the gas.

Mains and distributing pipes.

In the present Supplement to the Encyclopædia Britannica, the late Mr. Crichton states, that a pipe of an inch bore will supply 100 jets; but it ought to be observed that this only holds in peculiar circumstances. If we suppose a pipe of the above dimensions extended for 300 yards from the point of supply, we shall find that the jets will gradually diminish in intensity of light towards the extremity of such a pipe. It is, therefore, safer, even in point of economy, to calculate on the pipes being something above rather than below this statement, between the supply and quantity of light.

A want of experience on this branch of the establishment, and an increased demand for gas beyond what was calculated upon, has frequently created great trouble as well as very serious loss, not only in the works here, but in several of those in England. Accordingly, in some cases they have been obliged to lift and relay pipes of additional bore, and in others to lay down additional subsidiary mains. This has at no time arisen from any deposition of crystals or other matter in the pipes, so as to contract the area, but from want of sufficient practice to show what dimensions under different local circumstances would be needful, and from the increased demand alluded to.

Should you, therefore, suppose that an increase of light, to the extent of 10,000 jets would take place in a few years, it would then be prudent that the mains for the proposed establishment should not be less than 19 inches in diameter, and that the other distributing pipes in the various streets of the town be proportioned on the same ratio; and this must be obtained by a survey of the shops and other establishments where gas lights may be supposed to be taken in.

Valves and water traps.

The water valves which we should recommend as preferable to any other yet in use for shutting off the gas, must also be proportioned to the area of the pipes, where it shall be found needful to place them; and these, in all cases where they are needful, will serve not only as stop valves, but as drips to carry off the condensed vapours that collect in the pipes in a liquid form. The number of these necessary must also be ascertained by actual survey, and from the inclination of the streets.

Service and inside pipes.

The service pipes that branch off from the distributing ones, to convey the gas within such premises as are to be lighted, may be of cast iron, varying from ¾ to 1½ inch bore, and upwards, as the quantity of light to be supplied may determine. The pipes that have hitherto been fitted up for shops and other manufactories, have for the most part been of wrought iron, which have been found to answer better than copper ones, which were at first in use; but of late, block tin pipes have superseded in a considerable degree the others. Pipes of this description have advantages which strongly recommend them to consumers, and to manufacturers of gas. They are not acted upon by the gas so as to be corroded, nor does any matter adhere to their interior; consequently, any complaints or trouble that formerly occurred from these sources will be completely obviated.

Burners.

Argand burners of three different sizes, and jets of different figures, are pretty generally in use.—Each jet is equal to the intensity of light of a candle and half, weighing six in the pound, and will consume about one cubic foot of coal gas per hour. The No. 1 argand burner is equal in intensity of light to three of these jets, and will consume only about two cubic feet of gas per hour. The light derived from such a burner being much greater in proportion to the gas consumed, than in burners of the jet form, some would strongly recommend that argands as much as possible be used, as a matter of material interest to a gas company, and of comfort to the community. Some of the works in England, aware of this, give out none but argand burners to their customers, except in cases where they use meters.

THE SUPPOSED INFLUENCE OF THE MOON UPON THE WEATHER.

Of all the objects of physical inquiry, there are none, the causes of which we less understand, than those which produce the changes of weather. Why one country is petrified with cold, and another scorched with heat; why this region is drenched with rain, and that parched with drought, may, for the most part, be accounted for from the latitude in which they are situated, or from their proximity to, or remoteness from, seas and oceans. But why, in this or that country, there are such opposite states of weather in different seasons of the same year, or in the same seasons of different years, has as yet baffled all the efforts of philosophy to explain. In some quarters of the globe, indeed, the weather is at all times but slightly characteristic of the different seasons, and if it hardly makes any distinction between different seasons, it makes still less between different years. But in others, and particularly in our own, not only are the different seasons portrayed by the hand of nature in very opposite colours, but one year is often so unlike another, that a person would almost imagine himself transported to an entirely different climate. So frequent and so sudden, sometimes, are the changes in our atmosphere during certain seasons, that we have often three or four kinds of weather within the space of twenty-four hours; and it not unfrequently happens, that, while the earth performs a single revolution, the wind shifts through all the points of the compass. So remarkable, indeed, is the inconstancy of our weather, that it is the object with which we regularly compare a person, whom we wish to characterize as fickle in his temper, or unsteady in his purpose.

Within the whole range of nature, there is nothing in which man is more nearly interested than he is in the weather. The shifting of the wind, or the gathering of a cloud, may involve his happiness or his life. This sufficiently accounts for the frequency with which the weather is made the subject of conversation. Strange would it have been, had the mind, so prone to inquiry, left this important subject uninvestigated, and made no attempts to detect the causes by which so singular a phenomenon is chiefly regulated. But this is a subject on which, after all its researches, the genius of man has hardly yet been able to shed a ray of light; and which more than almost any other within the sphere of its observation, has demonstrated the impotency of the human intellect.

While the learned have been baffled and disappointed in their attempts to account for the various atmospheric phenomena, the popular mind has long had its theories and conclusions upon this abstruse subject. According to popular opinion, lunar influence is the grand cause which occasions most of the changes of heat and cold, frost and thaw, rain and hail, sunshine and tempest, with which this earth is visited. This doctrine, though certainly erroneous, is not an unconsolatory one, and it often affords the mind a ready resource for relieving itself from that uneasiness and melancholy which may have been engendered by a long course of disagreeable weather. Are we, for a succession of days or weeks, drenched with rain, or pinched with frost, the Almanack is dragged from its lurkings to inform us when the new or full moon is to bring us tepid gales or a cloudless sky! Were it not for this popular prejudice, the printers and venders of the Belfast and other cheap Almanacks, would have but an unprofitable employment. It may be farther observed, that, as people in affluence seldom mar the enjoyment of the present hour by reflecting upon their liability to be reduced to poverty, so, when the weather is at all agreeable to our feelings, or consonant to our wishes, we hear of none of those disastrous changes which the moon, careering in her course, is to produce by the time she arrives at a particular part in her orbit. It is chiefly, therefore, in the precarious seasons of spring and autumn, or the dreary months of winter, that we hear a word of the wonder-working phases of the moon. This may, however, arise in part from this luminary being of more importance to us, and, consequently, more attended to in these seasons than during the bright months of summer.

As nothing is so inimical to the progress of truth and knowledge as deep-rooted prejudices, we shall offer a few remarks with the view to obviate the common opinion, that the moon has great influence in producing the principal changes of the weather. It is easy to perceive the source whence this opinion may have arisen. That the ebbing and flowing of the tides are occasioned chiefly by lunar influence, has been long matter of notoriety. Without accurate observation, it was natural to infer, that a body which exercises so powerful an influence upon the fluid part of our earth, must exercise an influence equally powerful upon that elastic substance by which it is everywhere, and to a great height, surrounded. But what are inferences when unsupported by experiment or observation? The influence of the moon upon the ocean is quite undeniable; but that it does not act to the same degree, or to any sensible degree at all, upon the atmosphere, may be clearly demonstrated. The only way in which it can act upon the atmosphere, so as to affect the weather, must be either by heat or attraction. In the one case, it might occasion wind by rarefaction, and in the other, give birth to rain, by rendering it unable to support its usual load of clouds and vapour. Had the moon the power of effecting such changes as these, indications of them would be given by our instruments; but, as this luminary, shining in borrowed brightness, has no power of affecting the most delicate thermometer, so it performs its revolutions without causing the slightest elevation or depression of the mercury in the barometer, a thing which it could not do, had it the power of giving a spheroidal form to the air, as it does to the water. What greater proof than this can be desired, that the various changes in the atmosphere are quite independent of lunar influence?

But this conclusion may be strengthened by arguments drawn from other sources. Were the influence of the moon on our atmosphere such as popular prejudice would lead us to believe, not only ought the changes of the weather to be more regular and periodic than they are, but they ought likewise to be greater in those places that lye near to, or immediately under the lunar orb, than in places farther north or south. Now this is far from being the case. The farther we remove from those places which are illumined by the moon's perpendicular rays, the more irregular and frequent do we generally find the changes of the weather.—In addition to this it may be remarked, that, if the vicissitudes of the weather depend upon the phases of the moon, it must follow as a natural consequence, that all places nearly under the same meridian ought to experience a change of weather, nearly at the same time, as all have high or low water nearly at the same time. But will any one say that this is uniformly the case? Experience affords no data for such a conclusion, even with regard to places in the same country, and far less with regard to countries that are widely separated. While the county of Durham and the North Riding of Yorkshire, perhaps for a succession of weeks, have been experiencing changes almost every day, Hampshire and Sussex may, all this time, have enjoyed an unbroken uniformity of weather. Is any thing in physics more certain than that the mists may be dispelled from the plains of Britain, and the storm hushed among the mountains of Scandinavia, while the wind preserves its course, undeviating, upon the coast Guinea, and not a drop of rain descends to water the parched deserts that surround the kingdom of Bambarra?

But the absurdity of the opinion which, upon philosophical principles, we have endeavoured to refute, every one has the power to verify for himself. If he would only take the trouble to observe the weather narrowly during the course of a moon or two, he would find that while the latter is stated and regular in her course, the former is the most seemingly capricious and variable thing in nature. If a cause is regular and constant, must not the effect be so too? Supposing this reasoning to be just, we must no longer refer the changes of the weather to the agency of the moon. Is it not obvious to every one, that we have all kinds of weather at all the various stages of the moon, and, if this luminary has no power to produce any particular description of weather at different stages, what reason can there be to think that it can produce any change upon the weather at all?

LETTERS AND QUERIES.

ON THE OVERSHOT WATER-WHEEL.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—I intended to have offered a few remarks on A. B.'s ideas respecting the disadvantage of employing a crank in communicating the power of the steam engine, (No. LXII.) and also on a proposed improvement on the water-wheel by the same writer, if I recollect right; but I cannot lay my hand on the Number containing the latter article, to point it out. On the former subject I have been anticipated by W. C. in No. LXIV., who has proved, in a satisfactory manner, that A. B. has adopted mistaken ideas on that subject. I shall therefore endeavour to show, that he is equally mistaken in his notions of the water-wheel. It is exactly the same in principle as the crank; consequently, the same reasoning applies to both. In computing any power, it is as essential to know the velocity of the moving body, as the force with which it moves; for it is these two that constitute the power. This must ever be kept in view in all calculations of mechanical power, however it is produced. In an overshot water-wheel, the diameter of the wheel is the space through which the water descends in giving it motion, but instead of falling directly from the top to the bottom, it arrives there by describing a semicircle with the buckets. In the proposed improvement, however, which is a chain of buckets passing over one small wheel and under another, so placed that the top of the upper and bottom of the lower would be equal to the diameter of a common water-wheel; and through this space only the water in the chain of buckets would descend; although the water would act with its whole gravitating force always at an equal distance from the centre of motion, yet the space through which it acts being thus diminished in the ratio of the diameter to half the circumference of the wheel, which is as 1 to 1.57, and the gravitating force of the water in A. B.'s chain buckets, being to that on a common water-wheel as 1.57 to 1, the power of both in theory, is the same; but, in practice, the simple water-wheel would doubtless be greatly superior. As noticed above, the same reasoning applies indiscriminately to the crank or the water-wheel, the above statement may be illustrated by the very diagram which A. B. has used to prove the contrary. (See fig. 7. No. LXII.) The force exerted by a crank, or by buckets filled with water, round the semicircle A C B, is, to the whole force acting on the point C, as O G is to O C, which is as 2 to 3; but while the whole force could only act through the diameter A B, the diminished force would act round the semicircle A C B, which spaces are also to each other as 2 to 3; therefore, if the whole force 3, is multiplied by the space in which it acts, the product is 6; again multiply the diminished force 2 by 3, the space in which it acts, the product is also 6; demonstrating, that no power is lost either by the crank or water-wheel; and there is no ground to doubt that they are, respectively, far superior to any contrivance that has ever been proposed for the same end, regarding simplicity, durability, and friction.

I have some doubts of the correctness of W. C.'s views in the two last paragraphs of his letter in Number LXIV. After very justly observing how well the crank is adapted to the motion of the piston, he seems to think that the fly-wheel (whose momentum it is that enables the crank to guide the piston smoothly past its turning points,) controls the piston to the waste of its power. This would be true were the piston moving by an impulse that ceased to act till after a certain interval, for part of its momentum would be lost till the impulse was renewed; but the pressure is constant, and even increases as the piston is retarded; its control is beneficial throughout the whole stroke as well as at the turning points, as it allows it to accelerate through one half of its stroke, and retards it gently through the other. As to the supposition, that two engines acting on the same shaft counteract each other, I would observe, that they are not in the predicament of two race-horses striving who shall be first, but in that of two yoked in a plough or a carriage, where, if the one gives an extra pull, though he does not get before his fellow by the effort, he adds to the progress of both.

In the case of propelling a vessel, it is absolutely necessary that the engines should be so yoked together; for, if the one outstriped the other, the vessel would scarcely be kept from describing a circle.

The importance of sound principles on the above subject will be duly appreciated, when it is considered that it relates to the principal agents of mechanical power in this land of machinery.

I am, yours, &c. G. M.

Glasgow, 26th March, 1825.

ON THE APPLICATION OF LITHOGRAPHY TO THE ILLUSTRATION OF LECTURES.

GENTLEMEN,—I HAVE often thought that Lithography might be used with advantage, as an auxiliary aid to any lecture when diagrams are necessary. Suppose, for example, the principle of the steam engine was to be explained; I would propose, that each of the students should be furnished with a representation of it, and the proper letters of reference inserted in their right places. As the lecturer went on, they could follow him very readily; and when they went home, they could go over it themselves, or describe it to others; thus *spreading* the knowledge they obtained. To effect such a thing, I would have one drawn upon transfer paper, (which a boy at school could do,) and have impressions thrown off; for one of which no one attending would grudge a penny: and I think that would not only cover the expense, but remunerate the lithographer. They could be given into a book shop, where those who wanted them might be supplied.

The idea might be extended to many other things which will readily occur to you.—I am, yours, &c.

C. B.

Greenock, 27th March, 1825.

OBSERVATIONS on the Supposed Improvement of the MAGNETIC NEEDLE, by placing Iron in its Vicinity on Board of Ships.

SAY that observation is clearly got at sea, and the variation ascertained to a certainty, and to be a certain quantity, less or more, allowing that the compass bears 3° west or east off the pole of the earth;—say that the iron plate is placed so near to the compass as to alter it this very quantity, and that we then sail on the point that leads to the port, the vessel must come wide of the port, more or less, according to distance, owing to variation taking place betwixt the port and the place of observation; so that all that is acquired by this means, is neither more nor less than the common method of making allowance for the variation. Or, supposing that the compass is so confined that it will not alter, then sailing on any point, as the ship lyes so does the compass. Turn east or west, the compass is all the same, and becomes as useless as if the ship had none at all.

U. S. C.

QUERIES.

GENTLEMEN,—If you deem the following query which has occurred to me, worthy a place in your valuable weekly publication, its insertion will much oblige, yours, &c. X. Q.

West St. Vincent-Street, 7th March, 1825.

The altitude of a terrestrial object situated above the horizon, at three different stations in the same horizontal plane, being 30° 45′, 37° 43′, and 60° 12′; it is required to determine from thence the perpendicular height, with or without a demonstration.

MISCELLANIES.

Scylla.—As the breadth across this celebrated strait has been so often disputed, I particularly state, that the Faro Tower is exactly 6047 English yards from that classical bugbear, the Rock of Scylla, which by poetical fiction has been depicted in such terrific colours; and to describe the horrors of which Phalrion, a painter, celebrated for his nervous representation of the awful and the tremendous, exerted his whole talent. But the flights of poetry can seldom bear to be shackled by homely truth; and if we are to receive the fine imagery that places the summit of this rock in clouds, brooding eternal mists and tempests; that represents it as inacceptable even to a man provided with twenty hands and twenty feet, and immerses its base among ravenous sea dogs; why not also receive the whole circle of mythological dogmas of Homer, who, though so frequently dragged forth as an authority in history, theology, surgery, and geography, ought, in justice, to be read only as a poet. In the writings of so exquisite a bard, we must not expect to find all his representations strictly confined to a mere accurate narration of facts. Moderns of intelligence, in visiting this spot, have gratified their imaginations, already heated by such descriptions as the escape of the Argonauts, and the disasters of Ulysses, with fancying it the scourge of seamen, and that in a gale, its caverns "roar like dogs;" but I, as a sailor, never perceived any difference between the effect of the surge, here and on any other coast; yet I have frequently watched it closely in bad weather. It is now, as I presume it even was, a common rock, of bold approach, a little worn at its base, and surmounted by a castle with a sandy bay on each side. The one on the south side is memorable for the disaster that happened there, during the dreadful earthquake of 1783, when an overwhelming wave (supposed to have been occasioned by the fall of part of a promontary into the sea) rushed up the beach, and in its retreat, bore away with it upwards of 2000 people, whose cries, if they uttered any, in the suddenness of their awful fate, were not heard by the agonised spectators around.—*Smyth's Memoirs.*

Charybdis.—Outside the tongue of land, or Praccio di St. Rainiere, that forms the harbour of Messina, lies the Salofaro, or celebrated vortex of Charybdis, which has, with more reason than Scylla, been clothed with terror by the writers of antiquity. To the undecked boats of the Rhegians, Locoians, Zancleans, and Greeks, it must have been formidable; for even in the present day, small craft are sometimes endangered by it, and I have seen several men-of-war, and even a seventy-four gun ship, whirled round on its surface; but by using due caution, there is generally very little danger or inconvenience to be apprehended. It appears to be an agitated water of from 70 to 90 fathoms in depth, circling in quick eddies. It is owing, probably to the meeting of the harbour and lateral currents, with the main one, the latter being forced over in this direction by the opposite point of Pezzo. This agrees in some measure with the relation of Thucydides, who calls it a violent reciprocation of the Tyerhene and Sicilian seas; and he is the only writer of remote antiquity I remember to have read, who has assigned this danger its true situation, and not exaggerated its effects. Many wonderful stories are told respecting this vortex, particularly some said to have been related by the celebrated diver Colas, who lost his life here. I have never found reason, however, during my examination of this spot, to believe one of them.—*Smyth's Memoirs.*

Case of Sleep continuing for 451 days.—A sanitary report of a Prussian physician, addressed during the month of August to the Authorities, contains what follows: At Medeback in Westphalia, a young woman of twenty years, has slept 451 days. She was wakened only with difficulty in order to make her take food, and immediately slept again. From the commencement of her sleep, she only wakened once of her own accord. All the functions, even the periodical evacuations, are regularly performed. No cause could be discovered for this extraordinary sleep, unless it might be a hurt which she had previously received on the head.

REWARDS FOR INDUSTRY & TALENT.

The Publisher of the Glasgow Mechanics' Magazine, fully conscious of the unparalleled support his Work has received from the Mechanics and Public in general, anxious to show his gratitude, and with the view of contributing still farther to the increase of observation and scientific investigation, has resolved to offer for the present year, the following

PRIZES FOR COMPETITION,

TO BE AWARDED BY

Dugald Bannatyne, Esq. Secretary to the Chamber of Commerce.
R. Hastie, Esq. President of the Glasgow Philosophical Society.
James B. Neilson, Esq. Civil Engineer.
James Cook, Esq. Civil Engineer.

I.—TWELVE GUINEAS, and an HONORARY MEDALLION, for the best Essay, giving an Account of any original Invention in Science.

II.—FIVE GUINEAS, and an HONORARY MEDALLION, for the second best do.

III.—TWELVE GUINEAS, and an HONORARY MEDALLION, for a Description, with Drawings if necessary, of the most useful and important original Invention in the Arts.

IV.—FIVE GUINEAS, and an HONORARY MEDALLION, for the second best do.

V.—FIVE GUINEAS, and an HONORARY MEDALLION, to any Apprentice, for the best Specimen of Work in his Trade, made entirely by himself.

CONDITIONS.

The Competitors must be British Subjects.

Every Invention or Improvement for which the first four Prizes shall be claimed, must be that of the Competitor, the account of which must appear for the first time in the Glasgow Mechanics' Magazine.—Every Specimen of Work sent in competition for the fifth Prize, must be accompanied by a Certificate from the Master of the Apprentice, that the work is entirely his, and that he received no assistance whatever in executing it.

Competitors to transmit their Essays, Specifications, Drawings, or Specimens, free of all expense, with their names and address, "*To the Editors of the Glasgow Mechanics' Magazine, care of W. R. M'Phun, 155, Trongate, Glasgow,*" on or before the 1st January, 1826.

*** The description of Fig. 1. of the Plate, by John Deuchar, Esq. M. W. S. Lecturer on Chemistry, Edinburgh, has been unavoidably postponed until our next.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

Published every Saturday, by W. R. M'Phun, 155, Trongate, Glasgow, to whom Communications (post paid) must be addressed.

CURLL, PRINTER.

THE GLASGOW MECHANICS' MAGAZINE,

CONDUCTED BY

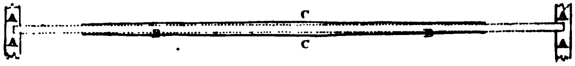
A Committee of Civil Engineers and Practical Mechanics.

……………………………… " Science here
And Candour dwell, prepared alike to cheer
The stranger guest, or for the nation's weal,
To pour the stores mature of wisdom forth!"

No. LXVIII. *Saturday,* 16*th April,* 1825. Price 3*d.*

IMPROVED IMPLEMENTS OF HUSBANDRY,

Invented ~~by~~ Mr. Dixon Vallance.



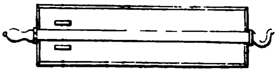
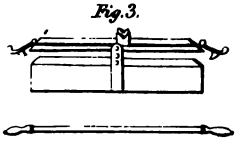
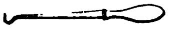


Fig.3.





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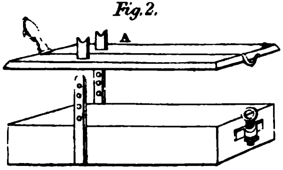
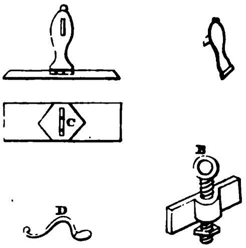




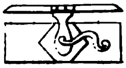


Fig.6.

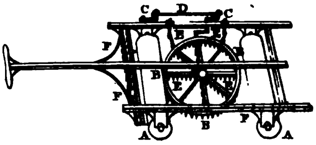


Fig.7.

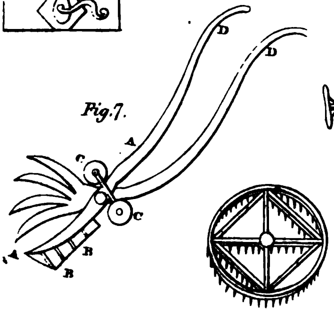


Fig.5.

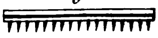
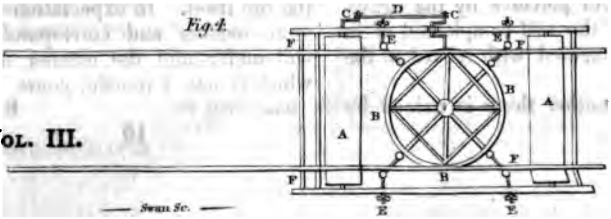


Fig.4.



Swan Sc.

IMPROVED IMPLEMENTS OF HUSBANDRY,

Invented by Mr. Dixon Vallance.

Gentlemen,—I have often observed that the teeth of the common harrow follow each other in the same track. They have, no doubt, been made of various forms; but still, in the greater number of instances, the teeth follow each other betwixt the furrows. It occurred to me on seeing this, that if harrows were made to revolve as they went forward, they would execute their work much better; and, in order to try this, I constructed a model, and made the harrow revolve round on its centre. This did very well, but I afterwards found that it did better to hang the harrow on four jointed iron rods, and make it revolve by the motion of a crank, as represented in the figures.

In addition to the hook and scythe, I have likewise invented a new instrument for shearing, represented in figure 1, which, from its simple construction, will be easily understood. It will be found well adapted to the shearing of grass in plantations, from among young trees.

I am, yours, &c.
Dixon Vallance.

Liberton, Lanarkshire,
25th March, 1825.

Description of the Figures.

Fig. 4 represents the revolving harrow, placed in a frame between two rollers. A, A, the rollers. A wheel and pinion on the front one of which, gives motion to the harrow B, B, B. C, C, the crank on the axle of the pinion, which gives motion to the harrow by the shaft D. E, E, E, E, the jointed rods which the harrow moves on, which have screws to raise or lower the harrow. F, F, F, F, two row of teeth placed in the frame at the front of each roller, so made as to be put in or taken out at pleasure.

Fig. 5, gives a plan and section of the wheel, showing the teeth of the harrow.

Fig. 6, the revolving harrow on a small scale, adapted for a garden.

In each of the figures, the parts are marked the same, to suit the above description.

Fig. 4, the grass-shears. A, A, the working blade, which has a raised back on it, to lay the tops of the grass all the same way. B, B, the back. The shears run on two wheels, six inches diameter, and are placed on the under side of the axle. C, C, the wheels and axle. D, D, the handles, which must be of wood, of sufficient length to prevent the shearer from stooping too much.

The length of shears' blades may be 1 foot 6 or 8 inches, and they may be five or six in number.

* * *

IMPROVEMENTS ON Mr. NORTH'S COPYING MACHINE.

Gentlemen,—Should you think the enclosed drawing of an improvement on C. North's copying machine, worthy of insertion in your Magazine, you will greatly oblige me by doing so.

You will perceive by the drawing, that the evil complained of in his, is remedied with regard to the lock.

But another thing is gained by the arrangement I have made, *viz.* that the pressure is more equally distributed over the surface, which, in the other, was principally in the middle; and, besides, that an additional lever power is gained by the top itself. In expectation that your readers and correspondents will understand the manner upon which it acts, I remain, yours, &c.

Broad-Street, 1825. R. R.

A, (fig. 2,) a bar of iron, with a hook at one end for moving in the loop of the screw B, which is fixed into the body of the press, and which allows it to be regulated to any height, by having a square nut at the bottom to keep it in its place. At the other end of the bar there is a hesp, which must move quite easy on the hinge; the small catch which projects from it, when the pressure is put on, falls into the hole in the end of the press (such as at C); but as it is not every one, perhaps, that could manage it in that way, there is a spring D attached to it which can be put upon the hesp before the pressure is put on. The spring is movable on a screw nail. C is a plate of iron, the same shape as represented in the drawing, having several holes in it; the lower end of the holes being inclined, so as the catch may slide easily into another should it be too slack.

The rest of the machine is the same as Mr. North's, which is represented in the Magazine.

Fig. 2, represents a machine with a hesp at each end, and the levers acting in the middle.

ON JOISTS OF HOUSES.

In one or two Numbers of your Work, some few weeks ago, there were some remarks on the proper position of the floor beams, or joists in a house. It seems to me, that there is a defect in the ordinary arrangement, which no builder has reflected on, or, at least, to which a remedy has not yet been applied. It is this: that the beams or joists are always made of equal dimensions throughout, though it is quite obvious, that the middle point, from wall to wall, has the greater weight to sustain in every case; and where, in fact, the greater weight is apt to accumulate; and there, in consequence, the floor is most apt to *bag*, or to decline downwards. To remedy this, the beams ought to be made stronger at the middle than at either of the two ends; that is, either *deeper* or *broader*. The former must be the most effectual; but as this would occasion an inequality in the *level* of the floor, the latter mode may be resorted to in order to strengthen the middle. The figure may, perhaps, better explain what is meant. Let A, A, (fig. 1,) represent the side walls of the house. B, B, included within the dotted lines, the present mode of formation, in which the beams or joists are of the same dimensions throughout; call this breadth, 2 inches. Let the full lines, C, C, tapering from 4 inches broad at the middle to 2 inches broad at the ends, represent the proposed construction in order to strengthen the middle. This addition, though only requiring *one half* more timber, will give *four times* more strength. It is easy to make the experiment, and it will be found so. Let it be tried on a small scale, and not to the extent as absolutely to break the rod through, but limited, say to a declension in the middle to the extent of to 2 or 3 or 4 tenths of an inch. Hence it will be found, that with a less quantum of wood, much more strength will be obtained. It is not necessary that the whole beam should be in one piece. The additions on the sides may be *fished* on, as in a ship's masts.

E. N.

POPULAR METHOD OF SOLVING QUESTIONS IN ASTRONOMY.

No. IV.

How to find the distance of any Planet from the Sun.

We have already shown the method of finding the earth's distance from the sun, and ascertained it to be about 95,070,110 miles; therefore, in order to find the distance of Mercury from the sun, say, by proportion, if 1000, the relative distance of the earth from the sun, give 95,070,110 miles, what will 387, Mercury's relative distance from the sun, give for his distance in miles?—And,

To find Venus' distance,

Say, if 1000 give 95,070,110 miles, what will 723 give for her distance in miles?—And,

To find the distance of Mars,

Say, if 1000 give 95,070,110, what will 1523 give for his distance in miles?—And,

To find Jupiter's,

Say, if 1000 give 95,070,110, what will 5201 give for his distance in miles?—And,

To find that of Saturn,

Say, if 1000 give 95,070,110, what will 9540 give for his distance in miles?

We shall now proceed to give the methods for ascertaining the size of the sun and the various planets.

How to find the size of the Sun.

It has been found by observation, that the sun is 32 minutes of a degree in diameter. Let us suppose a circle to be drawn round the earth as a centre, with the circumference going through the centre of the sun. Multiply 190,140,220 miles, (which is the diameter of the above circle, being twice the distance of the earth from the sun,) by $3\frac{1}{7}$, the quotient will be the circumference of that circle.

$$\begin{array}{r} 190140220 \\ 3\frac{1}{7} \\ \hline 570420660 \\ 27162888\frac{4}{7} = \frac{1}{7} \\ \hline 597583548 \end{array}$$

Then say, by proportion, if 360 degrees give 597,583,548 miles for the circumference of the circle, what will 32 minutes of a degree give for the breadth that the sun's body covers of that circumference? The answer (885308) is the diameter of the sun in miles.

```
     Deg.        Miles.          Min.
     360  :  597583548   ::   32
      60            32
     ----   -----------
             1195167096
            1792750644
            -----------
    21600) 19122673536 (885308  miles in the diameter
           172800                      of the sun.
           ------
            184267
            172800
            ------
             114673
             108000
             ------
              66735
              64800
              ------
               193536
               172800
               ------
                20736
```

How to find the size of the Moon.

It has likewise been found by observation, that the moon is $31\frac{2}{7}$ of a degree in diameter; therefore, say, by proportion, if 360 degrees give 1,507,658 miles for the circumference of her circle, what will $31\frac{2}{7}$ minutes of a degree give, for the breadth that her body covers of that circumference? The answer (2183) is the diameter of the moon in miles.

```
 Deg.       Miles.         Min.
 360   :  1507658    ::   31 2/7
  60          219            7
------   ---------        ------
21600    13568922          219
    7    1507658
------   3015316
         ---------
151200)  330177102 (2183 miles in the diameter of
         302400                   the moon.
         ---------
          277771
          151200
         ---------
          1265710
          1209600
         ---------
            561102
            453600
         ---------
            107502
```

How to find the size of any Planet.

When once the real distance of any planet is found, it is easy to find its real size from its apparent size, by the following method. We shall take Jupiter for an example, as he is the largest of the planets.

When Jupiter and the earth are in the nearest parts of their orbits to each other, he appears to us to be about $48\frac{1}{2}$ seconds of a degree in diameter; therefore, since Jupiter's distance from the sun is about 494,990,000 miles, and the earth's distance about 95,070,110 miles, subtract the earth's distance from the sun from Jupiter's, and it will leave the distance from the earth to Jupiter, when they are in the nearest parts of their orbits to each other.

```
494990000
 95070110
---------
399919890
```

Then, suppose (as in the case of the sun) a circle to be drawn round the earth as a centre, with the circumference going through the centre of Jupiter: multiply the distance from the earth to Jupiter by $6\frac{2}{7}$, the product will be the circumference of that circle.—This mode of finding the circumference, is equally the same as that of multiplying twice the distance by $3\frac{1}{7}$.

```
 399919890
       6 2/7
-----------
2399519340
  57131412 6/7 = 1/7
  57131412 6/7 = 1/7
-----------
2513782165 5/7  circumference of
                     the circle.
```

Then, since Jupiter's body takes up $48\frac{1}{2}$ seconds of a degree on that circle, say, by proportion, if 1,296,000 (the seconds in 360 degrees) give 2,513,782,165 miles, what will $48\frac{1}{2}$ seconds give for his real diameter in miles? The answer (94072) will be his diameter or thickness in miles.

$$\overset{\text{Sec.}}{1296000} : \overset{\text{Miles.}}{2513782165} :: \overset{\text{Sec.}}{48\tfrac{1}{2}}$$

$$\begin{array}{r l}
 & \underline{48\tfrac{1}{2}} \\
 & 20110257320 \\
 & 10055128660 \\
 & \underline{1256891082\tfrac{1}{2}} = \tfrac{1}{2} \\
1296000) & 121918535002\tfrac{1}{2}\,(94072 \text{ diameter in miles.} \\
 & \underline{11664000} \\
 & 5278435 \\
 & \underline{5184000} \\
 & 9443500 \\
 & \underline{9072000} \\
 & 3716002 \\
 & \underline{2592000} \\
 & 1123002
\end{array}$$

The real diameters of all the rest may be found in the same manner.

ON THE FORCE EXERTED BY HYDROSTATIC PRESSURE IN BRAMAH'S PRESSES; AND ON THE RESISTING POWER OF THE METAL; WITH RULES FOR COMPUTING THE THICKNESS OF THE SAME FOR DIFFERENT PRESSURES.*

By Peter Barlow, Esq. F.R.S., of the Royal Military College, Woolwich.

Mr. Barlow begins his paper by examining the amount of the strain exerted in the circumference of the cylinders, in consequence of any given internal pressure, and the result is the same as was first determined by Marriotte, although it has been somewhat differently obtained, *viz.* "The circumferential strain, on any given point of the interior of the cylinder, is equal to the pressure of a square inch multiplied by the number of inches in the radius;" that is, the force tending to rend the cylinder along any line parallel to its axis, is equal to the pressure on a section between the circumference and axis. This, as we have said, is the result which has always been deduced by the writers on this subject; but, in estimating the thickness necessary to resist this strain, it has universally been supposed, that all the metal in the thickness opposed an equally resisting power; from which it resulted, that, in presses of the same internal diameter, the thickness ought to be proportional to the pressure. This principle, however, is known to fail in practice, it having always been found requisite to increase the thickness in a higher ratio than the pressure; and it was principally with a view to correct this error, that Mr. Barlow undertook the investigation, at the earnest request of some of his practical friends; and, having completed it, it has been presented to the Society of Civil Engineers, who now rank amongst their numbers, many of the most distinguished names of the United Kingdom, connected with scientific and practical mechanics.

The following is the particular part of the investigation to which we have alluded.

---

* This Article is an Abstract of a Paper read before the Society of Civil Engineers, 22d February, 1825.

To investigate the nature of the resistance opposed to any given thickness of metal in a cylinder, or ring, from internal pressure.

It would appear, at first sight, that having found the strain on any points, D and C, it would only be necessary to ascertain the thickness of metal to resist this strain, when applied directly to its transverse area. This, however, is by no means the case; for, if we imagine, as we must do, that the iron, in consequence of the internal pressure, suffers a certain degree of extension, it will be found that the external circumference participates less in this extension than the interior; and as the resistance is proportional to the extension divided by the length, it follows, that the interior circumference, and every successive circular lamina, from the interior to the exterior surface, offers a less and less resistance to the interior strain. The laws of which decrease of resistance, it is at present our object to investigate.

In the first place, it is obvious, that whatever extension the cylinder or ring may undergo, there will still be the same quantity of surface in the section of the ring, which area is always proportional to the difference of the squares of the two diameters.

Let D be the interior diameter before pressure, and $D + d$ its diameter when extended by the pressure.

Let also D' be the exterior diameter before, and $D' + d'$ the same after the pressure.

Then, from what is stated above, we shall have

$$D'^2 - D^2 = (D' + d')^2 - (D + d)^2;$$

or, $2\,D'd' + d'^2 = 2\,D\,d + d^2$;

whence $(2D' + d') : (2D + d) :: d : d'$;

or, since d' and d are both very small, this becomes $D' : D :: d : d'$.

That is, the extension of the exterior surface is, to that of the interior, as the interior diameter is to the exterior.

But the resistance is as the extension divided by the length; therefore, the resistance of the exterior surface is, to that of the interior, as $\frac{D}{D'} : \frac{D'}{D}$, or $D^2 : D'^2$.

That is, the resistance offered by each successive lamina, is inversely as the square of its diameter, or inversely as the square of its distance from the centre; by means of which law, the actual resistance due to any thickness is readily ascertained.

Let r be the interior radius of any cylinder, p the pressure per square inch on the fluid, t the whole thickness of the metal, and x any variable distance from the interior surface. Let also s represent the strain exerted, or the resistance sustained, by the interior lamina; then, by the law last deduced, $(r+x)^2 : r^2 :: s : \frac{r^2 s}{(r+x)^2}$ = the strain at the distance x, from the interior surface; consequently,

$$\int \frac{r^2 s\,dx}{(r+x)^2} + \text{cor} = \text{sum of all the}$$

strains. This, when $x = t$ becomes

$$R = r^2 s \left(\frac{1}{r} - \frac{1}{r+t}\right) = \frac{s\,r\,t}{r+t}$$

That is, the sum of all the variable strains or resistances on the whole thickness t, is equal to the resistance that would be due to the thickness, $\frac{r\,t}{r+t}$ acting uniformly with a resistance s.

Let us now suppose (the above law being established) the radius r, and the pressure per square inch on the fluid p, to be given, to find the thickness necessary to resist it, or such that the strain and resistance may be in equilibrio, the cohesive power of the metal being also given. Let x represent the thickness required, and $c =$ the cohesive power of the metal per square inch; then the greatest strain the area $\frac{r\,x}{r + x}$ can sustain is $\frac{r\,x\,c}{r + x}$, and the strain it has to sustain is $p\,r$; whence, when these are equal, we shall have

$$r\,p = \frac{r\,x}{r+x}\,c, \text{ or } p\,r + p\,x = x\,c;$$

whence, $x = \frac{p\,r}{c - p}$.

Hence the following Rule in words at length:

To find the thickness of metal.

Multiply the pressure per square inch by the radius of the cylinder, and divide the product by the difference between the cohesive power of the metal per square inch and the pressure per square inch, and the quotient will be the thickness sought.

As an example, let it be required to determine the thickness of metal in two presses, each 12 inches in diameter; in one of which the pressure is $1\frac{1}{2}$ tons, and in the other 3 tons, per circular inch. The cohesive force of cast iron being 18,000 lbs. per square inch.

Here $1\frac{1}{2}$ tons per circular inch = 4,278 lbs. per square inch.
3 tons do. = 8,556 lbs. do.

Whence, by the Rule, $\frac{4{,}278 \times 6}{18{,}000 - 4{,}278} = 1.87$ inches thickness.

And, $\frac{8{,}556 \times 6}{18{,}000 - 8{,}556} = 5.43$ inches thickness.

Whereas, on the usual principle of computation, the one of these thicknesses would be exactly double the other.

ON BARKER'S MILL.

GENTLEMEN,—I observe that in your useful Magazine, you have of late brought the machine, called Barker's Mill, under the notice of the mechanical world; and, in my opinion, you deserve some credit for so doing. So far back as July last, in No. XXXI. page 25, Vol. II., B. V. inquires what is the present opinion with regard to this machine; and seems to think that there must be some mistake in the statements made with regard to it, otherwise that it would have got into general use. I have often wondered that none of our millwrights have ever attempted the introduction of this machine into this country; but I do not think with B. V. that their not having done so, is any evidence that the statements made with regard to it are erroneous. Millwrights, like other people engaged in business, are unwilling to run the risk of erecting a machine, the properties of which they do not know practically. By speculating thus, they might lose both their money and their professional fame, objects of too much importance in the world, to be thoughtlessly sported with. We have no chance, therefore, to see Barker's mill tried in this country, unless some person shall, in the first place, set one agoing on something of a large scale, and thus give it a fair trial. I am quite positive that, were it once tried, its adoption would be pretty general wherever there was a small stream of water, with a tolerably high fall.

This machine has been warmly recommended to practice by all the eminent mechanics who have investigated the subject; and, considering the high respectability of their names, and the *simplicity* and *cheapness* of the machine, it cannot but be matter of surprise that no attempts at its construction on a large scale have been made in Great Britain, where the motive power of water has been so much used. Indeed the application of water to the driving of machinery is so simple, so cheap, and so constant and equable in its action, that it amply merits the preference constantly shown it, whenever it can be obtained.

In the third volume of the Transactions of the American Philosophical Society, there is a description of one, of which the following dimensions are given:—The radius of the arms, from the centre pivot to the centre of the discharging holes, 46 inches; inside diameter of the arms, 3 inches; diameter of the supplying pipe, 2 inches; height of the working head of water, 21 feet above the points of discharge. This, though a great fall, is evidently a very small consumption of water, since it was all supplied by a two inch pipe; and when the machine was not loaded, and had but one discharging hole open, it made 115 turns in a minute. This gives a velocity of 46 feet in a second, for the orifice of discharge, which is 9 feet and 5-6ths in a second, faster than the water would flow out under the simple pressure of a 21 feet head, which great excess of velocity, can only be attributed to the prodigious centrifugal force generated in the arms, and upon which this machine in a great measure depends for its action.

If any thing I have stated, tends to attract attention to this subject, I shall be glad, for I am convinced it may be useful.

I am,
GENTLEMEN,
Your obedt. Servant,
A MILLWRIGHT.

Gorbals, 7th March, 1825.

TABLE *of the Strength of the Vapour of Water, in Terms of the Atmospheric Pressure, at different Temperatures, according to Fahrenheit's Thermometer.*

Temperature.	Pressure.	Temperature.	Pressure.	Temperature.	Pressure.	Temperature.	Pressure.
50	.006	120	.099	182	.500	245	2.00
60	.011	130	.130	190	.601	250	2.50
70	.017	140	.172	200	.760	261	2.75
80	.027	150	.225	212	1.00	268	3.00
90	.040	160	.287	221	1.22	275	3.35
100	.054	170	.371	230	1.48	279	3.50
110	.075	180	.465	239	1.80	312	5.50

Remarks.

In the above table, which only shows the comparative force of steam, the common or ordinary pressure of the atmosphere, is assumed to be 1.00 for the sake of simplicity, and because, in speaking of steam or condensed air, it is usual to compare it with atmospheric pressure ; and since it has been found that steam of the temperature of 212 degrees is just a balance to the ordinary pressure of the atmosphere, the term 1.00 stands opposite to that temperature to indicate that steam of that heat is equivalent to one atmosphere without a fraction. But if we take the temperature of 230 degrees, then 1.48 stands against it, indicating that when the heat is so raised, the pressure of the steam will be equal to one atmosphere and 48 hundredths, or very near an atmosphere and a half, while at 245 degrees it becomes equal to two, and at 268 to three atmospheres. It thus appears that equal increments of heat do not produce proportional increments in the force of steam, for it requires no less than 182 degrees of temperature to produce a strength of steam equal to 0.50, or half the pressure of the atmosphere, while the addition of only 30 degrees of heat, making 212 degrees, produces double the force, or 1.00, and a further addition of but 56 degrees, by raising the temperature to 268 degrees, increases its first power six-fold, or makes it equal to three atmospheres.

The pressure exerted by steam upon a boiler can be readily found by the table for any temperature within its limits, or on the contrary, if the pressure be known, the temperature of the water can be ascertained; for since the ordinary pressure of the atmosphere is equal to 14¾ lbs. or 14.75, so by multiplying the pressure found in the table for any given temperature by 14.75, the result will be the force exerted by the steam in pounds avoirdupoise against every square inch of surface in the boiler, presuming it to be surrounded by a vacuum. But since this can never occur in nature, where boilers are surrounded by the external air, so 14.75 lbs. must be subtracted from the product of the multiplication, and the remainder will be the actual effective force that remains for the boiler to support. Thus, for example, steam at 212 degrees produces no strain or force against a boiler, and if we multiply its representative number 1.00 by 14.75, the product will be 14.75 lbs. which is the pressure that would be exerted upon every square inch of the boiler to burst it, if it were surrounded by a vacuum ; but since it is surrounded by air, and that air presses with a force of 14.75 lbs. upon every square inch against the steam, the subtraction of this pressure from the first leaves no residue, and shows that no pressure exists. But if we take the temperature of 279 degrees, its equivalent number in pressure is 3.50, and this multiplied by 14.75 gives a result of 51.625 lbs. for the pressure upon every square inch in vacuo, and deducting 14.75 lbs. leaves 36.87 lbs. for the actual pressure that would be exerted by the steam upon every square inch of surface of a boiler surrounded by air. The number of square or superficial inches contained in the entire surface of any boiler can easily be ascertained, and this being multiplied by the pressure upon a single inch (found as aforesaid) will give the amount of the effective force which exists to burst or separate the parts of such a boiler, which ought in all cases to have a strength equal to at least three times the force it is intended to resist.

In like manner, if the force exerted by steam is known, the temperature of the water producing it can be determined by reversing the above operation, for whenever steam is found equal to two atmospheres, or 29½ lbs. on the square inch, its temperature must be 245 degrees, and so on for other pressures.

ANSWER TO QUERY BY IRRIGATOR.

We have always delayed noticing this Correspondent, in the hopes that some of our numerous readers would suggest something on the subject. In the circumstances Irrigator mentions, we think Montgolfier's hydraulic ram much better fitted for his purpose than the self-acting pump described in Number LVI. He will find a drawing, and a very particular description of the hydraulic ram, in No. IV. page 50, Vol. I.; and we beg leave to refer him to that Number for particulars. At the expense of about double the water raised, he will, by this machine, with the greatest ease, raise water to the height he wishes with the fall of two feet he mentions.

ADDRESS DELIVERED AT THE OPENING OF THE GLASGOW GAS WORKMEN'S INSTITUTION. By Mr. James Neilson.

With feelings of delight and satisfaction, in which I perceive you all most warmly participate, I meet you here, my friends, for the purpose of opening our Institution, as now enlarged; and I cannot for a moment suppose, that there is one present who will not ever look back on this day, as one of the most pleasant of his life. When this Institution has reached an eminence and an extent, in the contemplation of which we dare not yet indulge; when it has produced effects, it may be deemed presumptuous in us yet to anticipate, some of us may be still alive, who, with conscious dignity and honourable pride, may point to it and say, " we were of those who originally, with limited means and under great disadvantages, founded that Institution." Two years have barely passed away since our library was founded, and in that short time, we have done a great deal with very limited resources. Already our library is assuming a respectable appearance, and your industry and perseverance give a prospect that we shall soon possess an apparatus fitted for any scientific pursuit; and the kindness and liberality of the Committee of Directors of the work, has given us this commodious hall for our meetings, and the use of an excellent laboratory for making experiments.

Science, my friends, has within these few years been making rapid strides.—Principles long known have been more completely developed, and have been applied to purposes never before thought of; new principles have been discovered, and applied to most important uses; and, indeed, an impulse has been given to the human mind, which nothing but some fearful convulsion of the elements can ever lessen or retard.

May the spirit of inquiry which is at present abroad over the world, advance like an advancing tide; and may each new discovery exceed those which have gone before, as wave rolls over wave, till science and the arts shall reach an eminence which the most enthusiastic imagination cannot even conceive, and till the final consummation of all things, shall put a stop to this, as it shall do to every thing which is earthly.—New and wonderful discoveries have already startled the world; but, when these shall excite no longer any interest, newer and still more wonderful discoveries, shall astonish those coming after us, in ages yet within the womb of time.

In this march of science, Glasgow has

held no mean part. Here Black commenced and carried on those experiments which led to discoveries the most important in chemistry; and which, indeed, first gave it the appearance of a science;—and here Thomson and Ure continue exertions which are not only useful to the present day, but shall be to after time. From within the walls of our University, Smith first gave to Britain a knowledge of the science of Political Economy; and Reid taught morality to youth, and broke down the spirit of infidelity which the writings of Berkley and of Hume tended so much to increase. It was in Glasgow that the simple and elegant minded Watt brought to perfection those important improvements in the steam engine which have been so beneficial to the country, and have so raised his fame. But above all, it was in this city that the first example was given, so long a solitary one, of an Institution for the instruction of the Mechanics, and the Artizans, in the knowledge of Science and Philosophy; and, so far as I am aware, Glasgow has exhibited the first example of an Institution, such as ours, attached to a particular work, where most of the advantages of a public institution are afforded at a trifling expense, to those connected with the work. How much pleasure will it be to us to see this example followed by other public works, here and elsewhere, as other cities have followed the example of adopting a Mechanics' Institution. Indeed, every means should be adopted to advance knowledge among the people, as the working classes of the community have been most emphatically called.

Money has been called the blood of a state; and thus the monied interest has risen to a false importance in the scale of society; but it is the people who form the life-blood and the vivifying spirit of the body politic; and it is as they are wise and good, that a state will become great or happy. Let us look to ancient nations, where the people were held to be of such great importance, for evidence of the truth of this assertion. Greece and Rome are the objects of enthusiastic admiration for their literature, their arts, and the public spirit and love of country which pervaded their ctizens. In these favoured republics, the people were everything; the rich and idle few, were nothing.

The orators which these countries produced uttered not their orations before a few great and wealthy men, but before all who could admire eloquence and wisdom. Demosthenes, the greatest orator the world has yet seen, delivered his orations, (which yet in the very reading stir men's blood,) before the whole assembly of the people in the market-place; and it was for them he laboured so intensely to improve himself. Herodotus and Thucidydes wrote their histories, not for the rich man's library, but to be read before the people at the public games and festivals of the nation. Homer did not produce a poem, which has never been equalled, to please the vitiated taste of bloated and pampered wealth—but to please the healthy taste of his companions and fellow-citizens: and he traversed the greater parts of Greece, singing parts of his poems on the streets to those whom he knew could best appreciate his merits. Socrates, and Plato, and Xenophon, confined not their pure morals and their almost inspired wisdom to the few, but taught publicly all who chose to listen to them. It was not to adorn the halls of rich and splendid palaces alone, that Zeuxis produced paintings so wonderful in conception, and so felicitous in execution; or Phydias sculptures of such surpassing beauty, that the mind and the eye wearied not in contemplating them; but it was to adorn the temples and public buildings, and for the streets and squares of the city. Although, then, natural science was but little known and less studied, and books had not given such easy access to the stores of knowledge as are now afforded, still the people had ample scope for the exertion of intellect: in oratory, poetry, literature, and the fine arts, they were the critics and the judges. The consequence of this was the greatness and the prosperity of these ancient kingdoms; but when the people became ignorant and degraded,—lost their influence, and fell from the dignified station, in which they had hitherto stood, the States fell with them, and the character of the nation became degraded as they.

In modern times, besides all the knowledge of former ages, natural science and the arts thence arising have been added to the stores of human wisdom; and if we would preserve the grandeur and dignity of our country, we must seek the instruction and the improvement of the working classes of the community. It has been most happily said by one of the greatest of modern philosophers, that "knowledge is power;" in as much, therefore, as the working classes are the most powerful and important part of the community, a kingdom must become powerful and important as their knowledge is increased—and what branch of knowledge can be so important as natural science and the arts? Upon these the real greatness and prosperity, nay, the absolute safety and existence of modern nations depend; and the more a knowledge of these is spread abroad, the greater is the chance of improvement and advancement in them, because the greater is the quantity of intellect and mind employed in prosecuting and advancing them.

Let us look abroad upon what has been already done for the country by natural science, and we will at once see what, by this means, may yet be accomplished. Look to the public works and factories with which our city is surrounded, for the effects of machinery and the steam engine. Behold the largest ships plying the vasty deep, and seeking communication with the most distant regions of the globe, defying the tides and the winds of heaven. Nay, let us only look to our own work, and there we shall see a large and populous city, as if from a common centre, supplied by it with light, which is so essential to human happiness. How few years have elapsed since such things would have been considered as impossible; and how few years may yet elapse, ere other things at present as apparently impossible may be accomplished.

Institutions such as this, then, where natural science may be taught and studied, ought to be, and we hope yet to see them, common throughout the land, lending their feeble, no doubt, but when increased in number and aiding each other, their important light in the search after truth and knowledge. But besides the public advantages thus to be derived from such Institutions, there are other advantages, which, though not so showy or open to the world, are yet of immense importance to the individuals connected with the Institution. And there are many sources of real pleasure, which are opened up by thus unlocking the gates of the temple of knowledge, and giving entrance to all who wish to enter.—Pleasure and amusement will always be an object of man's desire: he is doomed, no doubt, to labour for his bread by the sweat of his brow; but there is no one so devoted to, or borne down by labour, as to have no time for amusement, or a desire to taste its fascinations; and, therefore, every man's object ought to be, to render these enjoyments as pure and as intellectual as possible. Such enjoyments yield most pleasure at the time, and afford most pleasure in after reflection; while sensual pleasures, whatever be their attractions at the time, are ever after a source of bitter and unavailing remorse. Intellectual enjoyments do not exhaust the body as sensual enjoyments do, and they improve the mind, while sensual enjoyments debase and destroy it. Happy he, who, despising and throwing behind him the worthless enjoyments of sense and all its allurements, can spend his leisure hours in the pure and simple pleasures which the study of literature and the arts present! His youth is continued delight, and happiness dwells with him; his manhood is pure and rational enjoyment, and intellect beams in his eye and brightens his manly brow; his old age is comparatively tranquil and easy; the young listen, with admiration, to the wisdom which drops like honey from his lips, and he sinks into the grave blessed and honoured by all who knew him. But how different the fate of him who is the votary of sensual enjoyments. Choosing what he conceives the primrose path of dalliance, he finds his mistake, only when it is too late to remedy it; and when his misery is increased, by the contemplation of what he has lost, and what he might have been had he chosen differently.—His youth is a scene of riot and dissipation; with manhood comes disease and an exhausted frame; and he either sinks into an early and unlamented grave, or wears out a lingering and miserable existence, despised and shuned by the virtuous and happy.

We have many examples of the pleasure which great discoveries have afforded to those gifted men who made them. Pythagorus, when he discovered the truth of the 47th prop. of the first book of Euclid, sacrificed a whole hecatomb of oxen to the Gods. Archimedes, when he discovered a method by which to weigh King Hiero's crown, ran out of the bath crying, "I have found it! I have found it!" and when he had ascertained the power of the lever, in the honest pride and pleasure of his heart, he said, "Give me a fulcrum and a standing place, and I will move the world." Great and valuable men! though we cannot imitate you in conferring blessings on the whole human race throughout all ages and all time, may we imitate you in being satisfied with, and enjoying the pure and simple pleasures derived from intellectual exertion. In this Institution, ample opportunity is to be found for prosecuting science, and obtaining those pure enjoyments of which we have just spoken, and which can alone render men truly happy. Seize the opportunity, then, thus afforded you, and let it not be said, that you might have been wise and virtuous, but that you despised to be so.

Before concluding, my friends, let me remind you, that the success of this Institution depends entirely on yourselves; on your own resources, and your own industry alone, can you depend for the means of preserving and of increasing it. Assistance, no doubt, you have received, and farther assistance you will, no doubt, still receive; kind friends viewing this Institution as it ought to be viewed, will, it is to be hoped, encourage so laudable an undertaking. But this is not to be trusted to. It may be received, but it may not. Let us, therefore, put trust in ourselves alone, and any assistance we may receive from others will be so much beyond our expectations.

Let me again recommend to you not to neglect the opportunity of receiving pleasure and instruction, which is now opened up to you. To the young I say, it is the season for improvement, make use of it when it is in your power, and you will not live long till you admit the benefit you have received. To the old I say, come ye likewise and receive instruction, it is not yet too late. The ardour and youthful enthusiasm of your minds is no doubt lessened, but you will yet receive much pleasure and much profit here.

REPLY BY GEORGE SUTHERLAND, ONE OF THE WORKMEN.

What we have this night heard from our President, ought to kindle the spark of congratulation and gratitude in the bosom of every member of this Institution; and how proud ought we to be at seeing this, our small establishment, so successful in the progress of its improvement, particularly when we consider that it is the first branch which hath grown out of the first seminary in the kingdom for spreading scientific information among the mechanics of this country. May ours, like it, be as prolific in the fruits of intelligence and useful knowledge.

Almost all persons have a desire for knowledge, yet men's inclinations are vastly different; and some take to one study, and some to another, as their talents or their inclinations lead them. This seems a wise provision in nature, well calculated to insure the discovery of what is new, and to preserve what is already known in science and the arts; and this wise end of hers would be frustrated, were men to enter upon the study of new sciences before they thoroughly understand those they have been previously engaged in investigating.—Considering the shortness of human life, and the copiousness of the arts and sciences, although it is good to know something of many sciences, yet it is necessary for every one to apply himself more particularly to that which the bent of his mind and his talents naturally incline him to. For it is thereby only that men have become famous; and, on the contrary, some persons striving to attain an universal knowledge, have failed of excelling in any thing; from whence it hath been, that they have been accounted less, who might otherwise have been esteemed greater. Thus, Plato, instead of improving philosophy, as he might no doubt have done, followed the bent of his genius in studying metaphysics: Socrates, morality; Democritus, natural philosophy; and famed Archimedes, the mathematics: and it is to the progressive improvement arising from this particular application of great talents, that we are indebted for the present improved state of morality, science, and the liberal arts. It is to the privilege which we moderns possess, in being thus benefited by, as it were, an accumulation of talent, that we are indebted for that superiority which we are enabled to claim over the ages of antiquity.

It is, however, my friends, to the valuable privileges which we enjoy under the patronage of a liberal legislature, that we are indebted for that copious development of moral and scientific intelligence, which justly entitles the inhabitants of this empire to assume the character of an industrious and an enlightened people; and the effect of which has laid the foundation and completed the bulwarks of that virtuous magnanimity which has made the world to wonder at our works, and her most populous empires to tremble at our strength. The satisfaction resulting from the knowledge that we live amidst so much toleration, is truly sufficient to fill every British bosom with the most patriotic feelings—to establish concord and tranquillity—to cause us to blush at the insignificance of provincial prejudice, or religious intolerance—and to unite all parties under the ties of paternal affection, and fraternal love.

To the indulgence of the Committee of Managers of this work, and the influence of that individual whose favour we have already so often felt, and whose generous feeling has at present so largely manifested itself, it is that we are indebted for the formation and enlargement of our Institution. To him, then, whose assistance is so important and examplary, whose sole motive is our instruction and improvement, and whose desire always is our interest, it becomes us gratefully and unanimously to render what assistance lyes in our power for the support and improvement of the establishment.

We, my friends, have witnessed its origin, and are in part sensible of its utility, but future experience and general improvement alone, can show the extent of that utility. May the success of this establishment exceed the wishes of its worthy founder, and the gratification thence arising be more than the delicacy of words can express!

LETTERS, QUERIES, AND ANSWERS.

ON MAKING GINGER BEER.

Gentlemen,—In No. LVI. Page 430, Vol. II. of your Magazine, Z. A. inquires the best mode of making Ginger Beer. I know not whether the following plan be the best or not, but I think it a pretty good one. Take 1½ oz. of ginger, well bruised, 1 oz. cream of tartar, and 1 lb. white sugar: put these ingredients into an earthen vessel and pour upon them a gallon of boiling water; when cold, add a table spoonful of yeast, and let the whole stand till the next morning. Then skim it, bottle it up, and keep it three days in a cold place, when it is fit for use. Good firm corks must be used, and they must be secured with twine or wire. Dick, in Nelson-Street, who makes the best Ginger Beer I have ever drank, uses lemons instead of cream of tartar. I am not aware if it is to this the superiority of his beer is owing, but it is considerably more expensive than cream of tartar.

I am, yours, &c.

A. Z.

ON REMOVING ECHOES IN CHURCHES.

Gentlemen,—In No. LIX. Page 16, Vol. III. of your Magazine, one of your Correspondents in Cupar inquires the best plan for getting rid of an echo in a church with which he is connected; and as I perceive no one has as yet said any thing on the subject, I beg leave to make a few observations.

It is well known that echoes are produced in every room by the reflection of the sound from the walls; and, consequently, the smoother and more unbroken the walls and roof are, the more will the echo be increased and reflected. In a large room it is often extremely difficult to prevent a very disagreeable echo. The best mode, however, of getting rid of what in a church must always be considered a nuisance, is by breaking the wall, or rendering its surface uneven by mouldings or other ornaments. A hole in the roof might have the effect your Correspondent wishes. Wool and saw-dust are both very bad conductors of sound; and carpeting, or moreen, or other woollen hangings or furniture, may be used beneficially. If the echo proceeds from a hollow partition or ceiling, it may be much diminished, and often altogether destroyed, by filling up the hollow with saw-dust. I shall be glad if these observations are of any use to your Correspondent, if you think them worthy a place in your excellent miscellany.—I am, yours, &c.

J. M. L.

EXPENSE OF OBTAINING A PATENT.

Gentlemen,—A Correspondent, in No. LXIV. Page 96, Vo the expense connected with obtaining a patent. It is not very easy to answer this question precisely, as the expense varies very materially under different circumstances. The ordinary expense is about £100 for each of the three kingdoms; so that before a patent can be obtained for Great Britain and Ireland, the expense is never less than £300. In many cases, however, it amounts to three times that sum.

I am, yours, &c.

A RESPONDENT.

QUERY.

GENTLEMEN,—If any of your able and numerous Correspondents could devise a plan by which an old waste may be drained out of a large unbroken extent of old workings, to the rise of my present workings, without endangering the lives of the men employed in pricking the waste, and at the same time allowing the present workings to be kept going, by allowing the waste to be run off, as the pumping engine can deliver it at the pit mouth, they will confer a great obligation not only upon me, but upon the whole coal trade. By the common mode, the workmen are in continual apprehension of being surrounded with water in the bowels of the earth, and often lives are lost, numbers of men are thrown out of employment for a considerable time, and great loss is sustained by the coal masters. Any practicable and safe plan, therefore, of obviating these dangers and losses, would be a favour to a numerous class of beings who labour for their daily bread in those regions of darkness and danger.

A COAL HEWER.

Waste is the technical name given to old workings full of water.

Rise-workings is the technical name given to those parts that are above the level of the other workings.

Pricking is the technical name given when the miner with his pick makes an opening into the waste.

USEFUL RECEIPTS.

To fix the Colours of Drawings in Chalk or Crayons.—In order to fix the colours of drawings in chalk or crayons, and keep them from rubbing off, it is recommended to pass the drawing through a vessel containing sweet or skimmed milk, when the desired effect will be produced.

A Paste or Powder for Razor Strops.—Take equal parts of sulphate of iron, (green copperas of commerce,) and common salt; rub them well together, and heat the mixture to redness in a crucible. When the vapours have ceased to rise, let the mass cool, and wash it, to remove the salt, and when diffused in water, collect the brilliant micaceous scales, which first subside; these, when spread upon leather, soften the edge of a razor, and cause it to cut smooth.

For cleaning Marble, Jasper, Siena, and Porphyry.—Mix up a quantity of very strong soap lees with quick lime, to the consistence of milk, and lay it on the marble you wish to clean, where it may remain 24 or 30 hours; it is afterwards to be cleaned with soap and water, and it will appear as if new.

To make Furniture Oil.—Put some alkenet root into a glazed pipkin, with as much linseed oil as will cover it; let it boil moderately, it will become of a strong red colour; let it cool, and it is then fit for use.

NOTICES TO CORRESPONDENTS.

B. D.—G.—A Workman—A. B. Dollar—have been received.

☞ Erratum in last Number; Page 138, line 3, *for* "19," *read* "9."—Errata in a few copies of this Number, page 146, col. 1, line 25, *for* "figure 1," *read* "figure 7."—Col. 2, line 23, *for* "Fig. 4," *read* "Fig. 7."—Page 147, col. 2, *for* "Fig. 2," *read* "Fig. 3."

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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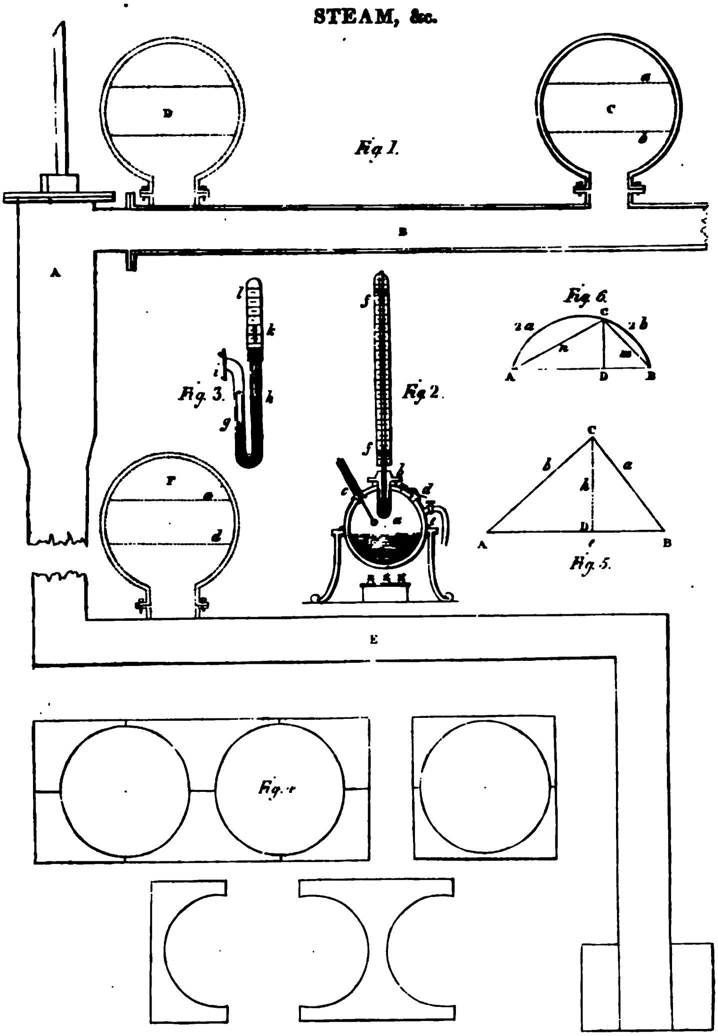
A Committee of Civil Engineers and Practical Mechanics.

" Waste not time, for time is the stuff that life is made of."

No. LXIX. *Saturday*, 23*d April*, 1825. Price 3*d*.

INSTRUMENT FOR MEASURING THE PRESSURE OF STEAM, &c.



— Swan Sc —

ON AIR VESSELS.

Air vessels on lying Mains.

In applying air vessels to a lying main, for the purpose of aiding a steam engine in raising water, and of keeping up a continued stream, we have often observed an error which not only renders them, we may say, entirely useless, but detrimental, causing them to add to the weight of the engine they are intended to lighten and relieve. It is often desirable, and would be more convenient, if it could be done with propriety, to have the air vessel outside the engine-house; but by doing this, it must, of necessity, be placed at a distance from the pump, in the immediate vicinity of which it ought to be. A very slight consideration of the subject will show at once how injurious this must be. Let us suppose the pump, A, (see fig. 1 of the plate,) which is worked by a steam engine, to be employed in lifting water, forced through B, the lying main. In order that a constant stream of water may be kept up in the main, it is necessary to use an air vessel; and in place of applying it at D, close to the pump, in order not to incumber the engine-house, or for some such reason, it is removed outside the house, to a distance of 20, 30, or 100 feet, say to C. Experience, however, has shown that in such a situation the air vessel does not perform the office for which it was intended, but causes it to be injurious to the working of the engine. For if we suppose the engine to be at work, and the pump lifting water, the main will, of course, be full of water. Now, it is obvious that the air vessel can have no beneficial influence on the water lying in the main, between it and the pump; so that every time the working box is raised, the body of water contained in this portion of the lying main requires to be put in motion, which must increase the burden of the engine. But this is not the only injury which the removal of the air vessel to a distance from the pump creates, for when the air is condensed in the vessel, and the water, by the lifting of the working box, rises in it to *a*, on the return of the box the air will begin to expand in the vessel towards *b*, expelling the water. The current thus created should flow through the main to the place of delivery, this being the intention of the vessel, and this would be the case, had it been placed at D; but from its distance at C, part of the expelled water will flow towards B, giving a retrograde motion to the water lying in that part of the main, which will thus meet the new current produced by the relifting of the box. We all know what immense force a column of water has when thus suddenly impeded in its progress, and how great a shock the engine and the main must sustain by the concussion.

We recollect of many instances of the defect of which we have been speaking, in which the concussion created by the opposing currents was excessive, and often burst the main and rent it in pieces. The whole, however, was cured by removing the air vessel to the immediate vicinity of the pump.

Air vessels on lying suction pipes.

Although not immediately connected with this, we beg to suggest to our readers that in all pumps, whether wrought by an engine or by the hand, where there is any length of lying suction pipe, as at E, it is extremely useful to have an air vessel on it, say at F, as it is a great ease to the burthen of the engine, or other power employed in lifting.

In the common hand pumps, where there was a portion of lying suction pipe, we have known, after the application of an air vessel, one man do more work, and with greater ease to himself, than two could have done without it.

◆

APPARATUS FOR MEASURING THE FORCE OF STEAM.

A most convenient apparatus for trying experiments upon steam on a small scale, is shown in section, fig. 2. It consists of a strong hollow copper or brass ball, *a*, about 4 inches in diameter, supported by a stand which admits a spirit or other powerful lamp to be placed under it for heating the water. On the upper part of the ball are four orifices; in the central one, *b*, an upright glass barometer tube of 30 or 40 inches long, and with an open top and bottom, is fixed by an air-tight screw cap, while the lower end of the tube dips into a small open-topped reservoir within the ball, containing just quicksilver enough to fill the tube. A mercurial thermometer is fixed by a similar cap, *c*, to the second orifice. The third, *d*, has a conical safely valve opening outwards, but which may be held down in a greater or less degree by an adjustable spring; and the fourth, *e*, is furnished with a stop-cock for the purpose of exhausting the ball of its air, or permitting the sudden escape of its steam, or conveying it away by a pipe for any experimental purpose: *f*, *f*, is a scale graduated to inches and tenths for observing the rise of the mercury. With such an apparatus, the heat of water, and its corresponding strength of steam, can be very accurately measured, for the thermometer measures the one, while the steam pressing on the surface of the quicksilver, and forcing it up the *glass tube, indicates the* other *by the height to which it ascends*, as measured upon the scale *f*, *f*; and by experimental researches made in this way, by M. Bettancourt, and afterwards rendered more correct by Mr. Dalton, and by others, it has been determined that the force of the confined steam of water, corresponding with different degrees of temperature, is very nearly as expressed in the Table which we gave in our last.

In making experiments upon steam, it is always best to judge of the state of its expansion by a mercurial guage, though the same thing can be done by valves properly loaded. In the instrument shown at fig. 2, the steam generated in the hollow ball, *a*, will press on the surface of the quicksilver in the small reservoir, and press it up the tube, *f*, *f*. But since steam at 212 degrees is balanced by atmospheric pressure, and the tube, *f*, *f*, is open at its top, the quicksilver cannot begin to rise until that temperature is increased; and as atmospheric pressure is very nearly equal to 15 lbs. on the square inch, and is balanced by about 30 inches of quicksilver in the barometer tube, it follows that each 2 inches of rise of the quicksilver in a tube like *f*, *f*, must be equal to 1 lb. of pressure or elastic force in the steam; and, consequently, a mercurial guage, when consulted in conjunction with a barometer, becomes a most accurate, and is a very sensible test for the strength of steam; and such a guage generally is, and ought always to be, applied to the boilers of all steam engines, or other vessels for generating steam, in order that the state of the confined steam may be accurately known. The guage usually applied to engine boilers is of the syphon kind, and consists of an iron tube bent into the form shown at fig. 3. and open at both its ends; *g*, *h*, is the tube, and *i*, a small plate or flanch, by which it is fixed to the upper part of the boiler, or to any pipe that communicates with the steam. The lower part of this tube is filled with quicksilver as from *g*, to *h*, and a slender stick, *k*, is introduced into the part, *h*, of the tube, so as to float on the surface of the quicksilver as it rises and falls; consequently, the upper end of the stick will point out any variation of height in the quicksilver upon the scale, *l*, *l*, which is graduated into inches and half inches. When no steam is operating on this instrument, the mercury will fall to the same lever in both the legs of the guage, and the top of the stick will be level with the bottom of the scale or top of the tube, *h*, but whenever steam enters at the orifice, *i*, it will press on the surface of the quicksilver at *g*, and elevate that at *h*, together with the stick, and thus point out the force of the steam. One inch upon this scale is equal to two inches, or a pound of pressure, in a straight tube, because as much of the quicksilver falls in the one portion of the tube as rises in the other.

PLAN FOR MAKING BRICKS FOR HOUSE VENTS TO PREVENT SMOKE.

To the Editors of the
GLASGOW MECHANICS' MAGAZINE.

GENTLEMEN,—In order to prevent soot adhering to the inside of vents, I would recommend that they should be cased with bricks, and that these bricks should be leaded in the inside like potter's ware. They could be made either whole or in segments, as represented in fig. 4, as might be found most useful, or might be considered necessary; and, in building, they should be jointed with putty. The soot, it is evident, will not adhere in any degree to such a vent, as it will be as smooth as glass; and the necessity of a chimney-sweep would thus be entirely superseded. A slater with his rope and whin bush would clean it preferably to any chimney-sweep, and this might be the means of abolishing such an inhuman trade. If any of your readers who are builders or brick-makers, will take this into their consideration and try it; if once begun, I think in a short time it would become universal. At the beginning many may startle at it, but it will only be for want of proper consideration.

I am, &c.

A.

Banks of the Clyde,
14th April, 1825.

ALGEBRAICAL PROBLEMS.

To the Editors of the GLASGOW MECHANICS' MAGAZINE.

GENTLEMEN,—Although I believe it would be improper to appropriate *many of the pages* of your useful Magazine to long scientific *discussions, yet*, as it is a journal intended to record the improvements of science and the arts, you will not likely object to the insertion of the following simple illustrations of several important propositions.

I. For sin a.

By trigonometrical formulæ, it is shown that

$$\sin \tfrac{1}{2} a = \sqrt{\frac{(s-b)(s-c)}{bc}}$$

$$\text{and } \cos \tfrac{1}{2} a = \sqrt{\frac{s(s-a)}{bc}}$$

$$\text{But } \sin 2a = 2 \sin a \,.\, \cos a$$

$$\text{or } \sin a = 2 \sin \tfrac{1}{2} a \,.\, \cos \tfrac{1}{2} a = 2 \sqrt{\frac{(s-b)(s-c)}{bc}} \sqrt{\frac{s(s-a)}{bc}}$$

$$= \frac{2}{bc} \sqrt{s(s-a)(s-b)(s-c)}$$

II. For the area of a triangle when the three sides are given.

Let a, b, and c, (fig. 5,) be the three sides, and s half their sum, and $CD = h$.

$$\text{Then, radius} : \sin A = AC : CD,$$

$$\text{or if radius} = 1,$$

$$1 : \sin A = b : h.$$

$$\text{Hence, } h = b \sin A.$$

$$\text{Now, area} = \tfrac{1}{2} AB \,.\, CD,$$

$$\text{or } a = \tfrac{1}{2} ch = \tfrac{1}{2} bc \sin A = \frac{bc}{2} \,.\, \frac{2}{bc} \sqrt{\left\{s(s-a)(s-b)(s-c)\right\}}$$

$$= \sqrt{\left\{s(s-a)(s-b)(s-c)\right\}}$$

III. For the value of sin $(a + b)$

Let A C B, (fig. 6,) be an arc, and let $AC = 2a$ and $CB = 2b$; then angle n is measured by b, and m by a. And since the chord of an arc is equal to twice the sine of its half, $AC = 2 \sin a$, $BC = 2 \sin b$, and $AB = 2 \sin (a + b.)$

$$\text{Now, radius} : \cos n = AC : AD,$$

$$\text{or } 1 : \cos b = 2 \sin a : AD,$$

therefore, $AD = 2 \sin a \,.\, \cos b$; and in the same way $BD = 2 \sin b \,.\, \cos a$; hence by adding $AD + BD$ or AB or $2 \sin (a + b) = 2 \sin a \,.\, \cos b + 2 \cos a \,.\, \sin b$; and $\sin (a + b) = \sin a \,.\, \cos b + \cos a \,.\, \sin b$.

IV. For the value of the sine and cosine of an arc in terms of an arc.

Let $\sin x = A x + B x^3 +$, &c. neglecting even powers as their co-efficients would be found to be $= o$.

Then $\frac{\sin x}{x} = A + B x^2 + C x^4$, &c.; and as x diminishes $\frac{\sin x}{x}$ approaches to 1 as its limit, hence $A = 1$.

When x becomes $2x$, observing that $A = 1$, $\sin 2x = 2x + 8 B x^3 + 16 C x^5 +$, &c.

But $\sin 2x = 2 \sin x$, $\cos x$, and, therefore, $\cos x = \frac{\frac{1}{2} \sin 2x}{\sin x} = 1 +$
$3 . B x^2 + 3 (5 C - B^2) x^4 +$, &c.

But $1 - \sin^2 x = \cos^2 x = 1 - x^2 - 2\,B\,x^4 - (2\,A\,C + B^2)\,x^6 -$, &c. &c.

And $\cos x = 1 - \frac{x^2}{2} - \frac{1}{8}(8\,B + 1)\,x^4 -$, &c.

Comparing the corresponding co-efficients of these two values of cos x, and observing that $A = 1$.

$$3\,B = -\frac{1}{2} \text{ and } B = -\frac{1}{2\,.\,3}$$

$$15\,C - 3\,B^2 = -\frac{1}{8}(8\,B + 1) \text{ and } C = \frac{1}{2\,.\,3\,.\,4\,.\,5}$$

$$\text{Hence, } \sin x = x - \frac{x^3}{2\,.\,3} + \frac{x^5}{2\,.\,3\,.\,4\,.\,5} -, \text{\&c.}$$

$$\text{and } \cos x = 1 - \frac{x^2}{2} + \frac{x^4}{2\,.\,3\,.\,4} -, \text{\&c.}$$

I am, Gentlemen, yours, &c.

A. B.

Dollar, 4th April, 1825.

ON THE CRANK.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—As I have not an opportunity of reading your Magazine weekly, it was only two days ago that I first read W. C.'s judicious criticism on my observations on the Crank. It is always pleasing to arrive at truth, and he has lent his aid to its thorough investigation. He has certainly shown that the loss of power is not so great as one-third; but it will be found, from the very nature of the crank, that there is some loss of power occasioned by its use. He has not, however, shown the fallacy in the reasoning. This fallacy lyes in the following argument:—When the power is applied at P, (see fig. 7, No. LXII. Vol. III.) only a part of it proportional to P K is effective. This argument is perfectly consistent with mechanical principles in the case of a number of weights sliding down the circumference of a fixed wheel, as, by the principles of the inclined plane, a portion of their weight would be *supported by the plane*, and another portion, proportional to P K, exerted; but circumstances are entirely changed when the wheel is moveable round its centre. Any weight placed at P, although it could not balance an equal weight at L, would support it in equilibrium at a point in the circumference, diametrically opposite to L, and hence all the weights on one half of the circumference being made to descend through the diameter of the crank, would raise a series of equal weights on the opposite circumference through an equal height; and, therefore, if the diameter of the crank were equal to the length of the stroke of the piston, no power would be lost. But unless the length of the beam be infinite, this diameter will not be equal to the length of the stroke. If, however, it be very long in comparison to it, the difference would be trifling; but then much power would be expended in dragging the beam alternately from rest to a state of motion. Taking the length of the beam, 12 feet, and that of the stroke, 3 feet, the extremity of the beam

MR. CLELAND'S PAMPHLET. *

This Pamphlet, as all Mr. Cleland's generally do, contains much useful information. Besides a history of the Steam Engine—an account of the Meetings in London and Glasgow for erecting Monuments to Mr. Watt—and a history of the application of Steam to the propelling of vessels—it contains many valuable Tables. We extract the following : —

The first Steam Engine erected in Glasgow, for spinning cotton, was put up in January, 1792, in Messrs. William Scott & Co.'s (afterwards Tod & Stevenson's) Cotton Mill, near Springfield, nearly opposite what is now the Steam Boat Quay. This was seven years after Messrs. Boulton & Watt put up their first Steam Engine for spinning cotton, in Messrs. Robinson's Mill, at Papplewick.

Number of Steam Engines in the City of Glasgow and its Suburbs, in April, 1825.

Manufacturers' Names.	Horse Power of Engine.	How employed.
Glasgow Water Works, 5 engines, 1 of 70, 2 of 30, 1 of 20, and 1 of 10 horse power,	160	Raising Water.
Robert Thomson & Son, 3 engines, 1 of 48, 1 of 25, and 1 of 20,	93	Spinning Cotton.
Cranstonhill Water Works, 3 engines of 30 each,	90	Raising Water.
Corporation of Bakers, 2 engines, 1 of 42, and 1 of 32,	74	Grinding Flour.
J. Bartholomew & Co. 2 engines, 1 of 60, and 1 of 12,	72	Spinning and Weaving.
John Monteith, 3 engines, 1 of 32, 1 of 25, and 1 of 14,	71	Spinning and Weaving.
Claud Girdwood & Co. 2 engines, 1 of 36, and 1 of 25,	61	Engine and Machine Making, Founding and Weaving.
David Todd, 2 engines, 1 of 35, and 1 of 16,	51	Spinning Cotton.
Macleroy, Hamilton, & Co.	50	Spinning and Weaving.
John Miller,	48	Spinning and Weaving.
James Corbet & Co. 2 engines, 1 of 32, and 1 of 14,	46	Spinning and Weaving.
Henry Houldsworth,	45	Spinning Cotton.
Lancefield Spinning Company,	45	Spinning and Weaving.
William Auld, 2 engines, 1 of 24, and 1 of 20,	44	Weaving and Snuff-making.
Henry Monteith & Co. 2 engines, 1 of 32, and 1 of 10,	42	Printing and Discharging.
James Dunlop,	42	Spinning Cotton.
Thomas Hervey,	40	Distilling.
Charles Todd, 2 engines, 1 of 20, and 1 of 18,	38	Weaving.
Muir, Brown, & Co. 3 engines, 1 of 20, 2 of 10, and 1 of 8,	38	Bleaching, Dyeing, and Discharging.

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* Historical Account of the Steam Engine, and its application in propelling Vessels; with an Account of the Proceedings at London, Glasgow, and Greenock, for erecting Monuments to Mr. Watt; also, a detailed Account of the Number and Power of Steam Engines in Glasgow. Compiled by James Cleland, Superintendent of Public Works for the City, Member of the Chamber of Commerce, &c. &c. Pp. 68. Glasgow; W. R. M'Phun. 1825.

has been proved in France by M. M. Vicat, Billoudel, Conrad, and De Thury, who, in consequence, consider the means as known, by which the powers of any building, stone, or material, to resist the disintegrating action of frost or weather, may be ascertained in a few days.

The stone having been selected, the cubes cut, and the solution of sulphate of soda (saturated at common temperature) made, the solution is to be boiled, and whilst boiling freely the specimens are to be introduced. The stones are to be boiled for half an hour and not longer: M. Vicat having shown, that afterwards the effect surpasses that of frost. The specimens are then to be withdrawn one after the other, and suspended by threads, so that they do not touch each other, or any thing but the thread; a vessel containing some of the clean solution in which they have been boiled, is to be placed beneath each, after which the vessel and its accompanying specimen are not to be separated.

If the weather be not too moist or too cold, the specimens will be found covered in 24 hours, with small white saline needles. They are then to be plunged, each into the particular portion of solution beneath it, when the needles fall off, and are again to be suspended in the air. A repetition of this process is to take place each time the needles are well formed. If the stone under trial is capable of resisting the action of frost, the salt will remove nothing from it, and neither grains, nor scales, nor fragments, will be found at the bottom of the solution beneath. On the contrary, with a stone which gives way to the weather, it will be seen that even on the first day the salt will remove particles from it, the cube will lose its angles and edges, and ultimately there will be found at the bottom of the vessel all that has been detached during the trial. The trial should be concluded at the end of the fifth day after the salt has first appeared in crystals. The formation of crystals may be facilitated by moistening the stone as soon as they have appeared on any one point; this may be repeated five or six times a day.

Great care should be taken that the saturation of the water by the salt be effected at common temperatures. The experiments of M. Vicat and others have demonstrated, that stone, which resists perfectly the action of frost or of cold solution of sulphate of soda, gives way entirely when exposed to the action of a saturated hot solution: the same is the case frequently also, if the trial be continued beyond the fifth day. Mortars and bricks which had withstood ten winters gave way to saturated hot solution; and M. de Thury found, that lias and other stones which had resisted the weather for ages, were disintegrated by the same excessive kind of trial: from which it may be concluded, that stones which can resist these trials would scarcely undergo any change by exposure to weather for any length of time.

If it be required to estimate comparatively the power possessed by two or more kinds of stone to resist the action of frost; the portion of matter separated from them, and lying in the solution beneath, is to be collected, washed, dried, and weighed; and the weight indicates the proportion in which the samples tried would suffer by exposure to weather and frost.

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Anderson & Co.	36	Lamp Black Making, and Grain Grinding.
Mile-end Spinning Company,	36	Spinning Cotton.
William Hussey,	36	Spinning Cotton.
Thomas Lancaster,	36	Weaving, Printing, and Discharging.
James Crombie, 3 engines, 1 of 14, 1 of 12, and 1 of 10,	36	Spinning Cotton.
John Wilson,	32	Spinning and Weaving.
Finlay, Connal, & Co.	32	Spinning Cotton.
Couper, Maitland, & Co.	32	Spinning and Weaving.
Bogle & Ferguson,	32	Spinning Cotton.
Colin Gillespie, 2 engines, 16 each,	32	Weaving.
James Oswald & Co.	30	Spinning Cotton.
Charles Tennent & Co.	30	Chemical Operations.
George Buchanan & Sons, 2 engines, 1 of 16, and 1 of 14,	30	Calendering.
William Ewing,	28	Weaving.
James M'Donald,	25	Spinning and Weaving.
Dugald M'Phail,	25	Spinning and Weaving.
James Edington,	25	Founding and Weaving.
George Forster,	25	Spinning and Weaving.
William Clark, 2 engines, 12 each,	24	Weaving.
Reid & Whiteman,	24	Weaving.
Moses M'Culloch & Co.	24	Smith Work and Founding.
George Aitken,	20	Weaving.
John Clark & Co.	20	Spinning Cotton.
William Perry,	20	Spinning and Weaving.
Thomas Edington,	20	Founding and Grain Grinding.
John Glass,	20	Dyeing and Discharging.
William Sim,	20	Grain Grinding.
Douglas Wardrop,	20	Weaving.
M'Lellan & Turner,	20	Weaving.
John M'Ausland,	20	Weaving and Cutting Wood.
Angus Shaw,	20	Spinning Cotton.
Black & Co.	20	Calendering.
Andrew Smith,	20	Weaving.
James M. Graham,	20	Spinning Cotton.
John Black & Co.	20	Calico Printing.
R. F. & J. Alexander,	18	Twisting Yarn.
Wardrop & Hervey,	16	Weaving.
Andrew Campbell,	16	Weaving.
Daniel M'Phail & Co.	16	Spinning Cotton.
Patrick Dawson,	16	Distilling.
John Gourlay & Co.	16	Distilling.
Brown & M'Nee,	16	Weaving.
William Kerr & Co.	16	Calendering.
William Aitken,	16	Spinning Cotton.
Hector Grant,	14	Weaving.
Robert Blackburn & Co.	14	Spinning and Weaving.
Andrew Thomson,	14	Spinning Cotton.
John Barr & Co.	14	Spinning Cotton.
Leishman, Dunlop, & Co.	14	Spinning Cotton.
Robert M'Farlane & Co.	14	Distilling.
John Forsyth,	14	Pottery and Fire Brick.
J. & A. Monach,	14	Spinning Cotton.
Rockvilla Mill,	14	Distilling and Grain Grinding.
Stevenson, M'Lean, & Co.	14	Calendering.
Reid & Jones,	14	Calendering.
Robert M'Laren,	14	Spinning Cotton.
John Cairnie & Co.	14	Distilling.
Glasgow Foundry Company,	14	Founding.

William Dunn, 2 engines, 1 of 8, and 1 of 6,	14	Machine Making and Spinning Cotton.
James Johnston,	14	Weaving.
John M'Lean,	14	Weaving.
Neil Snodgrass,	12	Spinning Cotton.
Anderston Foundry,	12	Machine Making and Founding.
David Napier,	12	Engine Making and Founding.
Francis Marr & Co.	12	Spinning and Weaving.
John M'Aulay,	12	Grain Grinding.
Joseph Scott,	12	Grain Grinding.
James Taylor,	12	Calendering.
Malcolm M'Lean & Co.	12	Calendering.
John Stevenson & Co.	12	Dyeing and Discharging.
James Cook,	12	Engine and Machine Making.
H. & R. Baird,	12	Engine Making and Founding.
Robert Napier,	12	Engine Making and Founding.
Hamilton Garden,	12	Raising Water.
Archibald Turner,	10	Spinning Cotton.
Bowman Fleming,	10	Bleaching and Dyeing.
Blair & Morrison,	10	Calendering.
Crawford & Co.	10	Calendering.
Ure & Bankier,	10	Calendering.
Murdoch & Cross,	10	Engine Making and Founding.
Samuel Wilson,	10	Sugar Refining.
Malcolm Muir & Co.	10	Veneer Sawing.
Dr. Drew,	10	Bleaching and Dyeing.
J. & M. Mitchell & Co.	10	Tambouring.
George M'Intosh & Co. 2 engines, 1 of 6, and 1 of 3,	9	Chemical and Cudbear Operations.
Anderston Brewery,	8	Grinding Malt and Pumping Worts.
Donald M'Donald,	8	Spinning Cotton.
Mrs. M'Kinlay,	8	Fire Brick Making.
Watt & Archibald,	8	Turning and Cutting Wood.
Walter M'Queen,	8	Bleaching and Dyeing.
John M'Kay,	8	Wool-Carding.
Alexander Herbertson,	8	Weaving.
James M'Nair,	8	Sugar Refining.
Robert Struthers,	6	Grinding Malt and Pumping Worts.
Archibald Liddell,	6	Grinding Colours.
William M'Andrew,	6	Engine Making and Founding.
Duncan M'Arthur,	6	Engine Making.
John Geddes,	6	Glass Grinding.
Archibald Geddes,	6	Glass Grinding.
Andrew King,	6	Weaving.
John Neilson,	6	Engine Making.
Pollock & Blackie,	6	Founding.
John Roberton,	6	Founding.
Charles Gray,	6	Distilling.
James Fleming,	6	Bleaching.
James M'Dougal,	6	Calico Printing.
George M'Leod,	6	Grinding Drugs.
John M'Intyre,	6	Smith Work and Founding.
Parlane & Ure,	6	Calendering.
A. M'Lellan & Son,	6	Coach Making.
William Bryden & Co.	6	Coach Making.
Stephen Miller & Co.	6	Founding.
William Brown & Co.	6	Grinding Colours.
Samuel Hall & Co.	6	Singeing Muslins.
William Watson,	6	Engine and Machine Making.
Thomas Baird & *Son,*	6	Dyeing and Printing.
Walter Stewart & Co.	6	Grinding Malt and Pumping Worts.

Connal & Co.	6	Distilling.
Port-Dundas Foundry,	4	Founding.
Archibald Arthur,	4	Printing and Grinding Indigo.
Gow & Co.	4	Bleaching and Dyeing.
Gas Work,	4	Gas.
J. & H. Wardrop,	4	Coppersmiths.
Apothecary Company,	4	Grinding Drugs.
Matthew Balmanno,	4	Grinding Drugs.
John Roxburgh,	4	Tanning.
John Bell,	4	Fire Brick Making.
John Fulton,	4	Founding.
John M'Donald & Sons,	4	Dyeing and Discharging.
John Spence,	3	Smith Work.

Total,……Manufacturers, 149——Engines, 176——Horse Power, 2970.

Average Power of Engines, $16\frac{875}{1000}$.

ABSTRACT.—*Horse Power, how distributed.*

	Horse Power.
Spinning Cotton,	893
Weaving,	665
Raising Water,	262
Bleaching, Dyeing, Printing, and Discharging,	206
Calendering,	154
Grain Grinding,	153
Founding,	124
Distilling,	119
Engine Making,	62
Chemical Operations,	39
Machine Making,	37
Snuff Making,	22
Fire Brick Making,	19
Sugar Refining,	18
Lamp Black Making,	18
Twisting Yarn,	18
Carried forward,	2809

	Horse Power.
Brought forward,	2809
Smith Work,	18
Grinding Drugs,	14
Coach Making,	12
Glass Grinding,	12
Grinding Malt and Pumping Worts,	20
Grinding Colours,	14
Veneer Sawing,	10
Tambouring,	10
Cutting Wood,	18
Wool Carding,	8
Pottery,	7
Singeing Muslin,	6
Gas,	4
Coppersmith,	4
Tanning,	4
Total,	2970

The above exhibits the horse power employed in Spinning and Weaving in Glasgow and its Suburbs, extending not more than two miles from the Cross, but gives no idea of the power employed in the Cotton trade at a greater distance, by Glasgow Manufacturers; Messrs. Robert Owen & Co.'s establishment at New Lanark, James Finlay & Co.'s at Deanston, Ballandalloch, and Catrine, and William Dunn's at Duntocher, Faifley, and Milton, alone, contain Water Twist and Mule Spindles, equal to 236,000 of the latter description. If the works of Messrs. Henry Monteith & Co. at Blantyre—William Kelly, at Rothsay and Blackburn—and of the other great Manufacturers belonging to Glasgow, were taken into account, the extent of business done at these establishments, would be shown to be much greater than is generally understood.

Number of Steam Engines employed in Collieries in the Neighbourhood of Glasgow.

	Horse Power.
Clyde Colliery, 3 pumping engines, 1 of 64, 1 of 54, and 1 of 16; 6 winding engines, 2 of 18 each, and 4 of 11 each. This power includes Hamilton Farme Colliery,	214
Govan Colliery,* 2 pumping engines, 1 of 54, and 1 of 42; 1 pumping and winding, 20; 4 winding, 1 of 18, 2 of 14, and 1 of 9; 1 rotatory engine, 16,	187

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* *These Collieries* vary greatly in the quantity of Coal they put out. During the

West Muir Colliery, 2 pumping engines, 1 of 78, and 1 of 58; 3 winding engines, 2 of 16 each, and 1 of 10,	178
Eastfield Colliery, 2 pumping engines, 1 of 72, and 1 of 54; 2 winding engines, 1 of 23, and 1 of 14,	163
Old Farme Colliery, 1 pumping engine, 72; 2 pumping and winding engines, 19 each; 2 winding engines, 1 of 18, and 1 of 10. This power includes Wellshot Colliery,	138
Stonelaw Colliery, 2 pumping engines, 1 of 51, and 1 of 35; 3 winding engines, 14 each,	128
Knightswood Colliery, 1 pumping engine, 56; 3 winding engines, 2 of 10, and 1 of 8,	84
West-thorn Colliery, 1 pumping engine, 26; 3 winding engines, 1 of 14, and 2 of 13 each,	66
Dalmarnock Colliery, 1 pumping and winding engine, 18, and 1 pumping, 46, ...	64
Barrowfield Colliery, 2 pumping and winding engines, 1 of 26, and 1 of 14; 1 pumping engine of 20,	60
Prockiemuir Colliery, 1 pumping engine, 29; 1 winding engine, 12,	41
Gairbraid Colliery, 1 pumping engine, 18; 2 winding, 1 of 8, and 1 of 4,	30
Dalbeth Colliery, 1 pumping and winding engine,	24
Belvidere Colliery, 1 pumping and winding engine,	22
Hillhead Colliery, 1 pumping engine,	8
East Woodside Colliery, 1 pumping and winding engine,	4
Total,	1411

Total,...Collieries, 18——Engines, 58——Average Power of Engines, $24\frac{327}{1000}$.

Steam Engines in Stone Quarries.

	Horse Power.
Westmuir,	11
Garscube,	6
Kelvinholme,	6
Firework,	4
Possil,	4
Kelvinhaugh,	4
Eastfield,	4
	39

Total,...Quarries, 7——Engines, 7——Average Power of Engines, $5\frac{571}{1000}$.

GENERAL ABSTRACT.

	Number of Engines.	Horse Power.
In Manufactures,	176	2970
In Collieries,	58	1411
In Stone Quarries,	7	39
In Steam Boats,	68	1926
In Clyde Iron Work,	1	60
Totals,	310	6406

Average Power of Engines, $20\frac{664}{1000}$.

The difference of cost between the price of Coals consumed by Steam Engines and the keep, &c. of horses, must ever vary with circumstances. The following will give some idea of the difference:—A heavy horse, working 10 hours, will consume 15 lbs. avoir-

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year ended 1st March, 1823, exclusive of retail sale, the Govan Colliery shipped at the Broomielaw, no less than 283 vessels of Coals; supposing each vessel to contain 50 tons, the whole would amount to 14,150 tons. The workings of the Govan Colliery, adjoin the Haugh and upper part of the Green of Glasgow, which is full of Coal, and capable of being worked without injuring the surface of that park so justly valued by the citizens.

In 1824, the output from Farme, West Muir, and Govan Collieries, amounted to *210,000 carts of 12 cwt.*

dupois of oats, and 14 lbs. of hay per day—an Engine of 30 horse power, working 10 hours per day, in a mill, will consume, on an average of summer and winter, about 4 tons of coal dross. The Steam Boat, Toward Castle, from Glasgow to Rothsay and back again, a distance of about 80 miles, consumes 5½ tons of hard coal in 12 hours.

HURTFUL INFLUENCE OF BAKERS' BREAD.

A correspondent of the *Lancet* says, "A physician, of extensive practice and long experience, has made the following remark: That out of fifty cases of indigestion, and its consequent calamities, thirty-nine, on an average, may be cured by obliging the patient to use home-made bread, instead of that which is made by the baker." The writer of this article, also a medical man, can confirm, from his own experience as well as an extensive practice, the truth of the above remark, communicated to him by a brother physician. Bakers' bread is a perfectly *sui generis* substance, and is unlike any other bread. It always contains a portion of alum, and the subcarbonate of potash, and some other unknown ingredient. The proof of good bread is its keeping. Country bread will keep good a week, and this is a better test of the genuineness of bread than the usual test employed for alum. Bakers' bread binds the bowels, and produces nervous disorders in many persons of an alarming kind; and the writer well remembers the improved health enjoyed by the students of the College at which he was educated, after the medical professor had forbidden the use of bakers' bread, and an oven had been erected for the college baking.

REMARKS ON HONES FOR RAZORS.

An error in a table of logarithms may, indeed, chance to cause some trouble to a nautical and astronomical computer, once or twice in the course of twenty years; but a bad razor is a daily annoyance to seamen as well as to landsmen, to astronomers as well as to gastronomers; and I, therefore, think it right to communicate some observations which have saved me a minute or two, on an average, every day of my life, for the last two or three years, and have spared me perhaps, 100 out of 300 alternate motions of the hand and arm.

I have long been in the habit of using soap and water with the hone, in preference to the oil which *is commonly employed*; though I *still doubt whether* a constant immersion in oil might not, after all, keep the hone in the best possible order. But in any way that the hone is kept dry, its surface seems, in the course of a few months' use, to become hard or clogged, so that it will cut but very slowly; notwithstanding, it may, at first, have possessed the requisite perfection of being soft enough to be scratched by a pin.

The remedy is to give it, every two or three months, a new surface, by a piece of common coarse whetstone, such as is used for scythes; and immediately after this renovation, a razor may be set in one minute as effectually as in ten by the same hone before the operation.

Misopogos.

MISCELLANIES.

Evans' new method of Roasting Coffee.—This process, for which a patent has been taken out by Mr. R. Evans of London, consists in preventing any of the oily parts of the coffee, which contain the aroma, from evaporating during the process of roasting it. The machine consists of a cylindrical vessel turned by a winch and two wheels. It has ledges within to throw the beans from the side to the middle of the cylinder. At the middle of the cylinder, opposite to the handle, a tube passes from the open air to beyond its centre, having a number of perforations in it. During the first period of the roasting, the aqueous parts which the heat drives off, pass through the holes of this tube; but when all the water is driven off, this tube is shut up, and, consequently, during the last period of the roasting, the aromatic oil does not escape from the beans.

In order to ascertain the precise time when the aqueous vapours are dispelled, he holds a piece of slate against the outer end of the tube with perforations, and the deposition upon its surface, if watery or gummy, shows whether the water or the oil is escaping. Small quantities of the beans are occasionally taken out with a spoon through the axle, to observe the progress of the operation.

An account of the Lapidary's Wheel of the Hindoos.—This wheel, used for cutting precious stones, is composed of one part gum-lac, and two parts of powdered corundum (or emery). The corundum powder is first heated in an earthen vessel, and when the heat is such as to melt the gum, it is added in portions, the whole being stirred round to promote a perfect union. The paste thus made is beaten with a pestle on a smooth slab of stone; it is then rolled on a stick, and reheated several times. When the mixture is uniform, it is then taken from the stick and laid on the stone table, which must be previously covered with fine corundum powder, and then flattened into the shape of a wheel, with an iron rolling pin. The wheel is then polished by a plate of iron and corundum powder, and a hole is made through the middle of it by a heated metallic rod.—When the wheel is mounted on a horizontal axis, the workman gives it a motion of rotation with a spring bow, and holds the stone which he cuts in his left hand, applying occasionally corundum powder and water. The polishing is affected by leaden wheels and a finer powder.

Casting of Wooden Ornaments and Veneers.—A discovery is said to have been made in France, of a method of converting pulverised wood, or saw-dust, into a solid substance, by which curious wooden articles may be formed in moulds at a small expense, out of rare and valuable woods. (See Newton's Journal of the Arts, Vol. IX. page 35.) The only difficulty which is opposed to such a method, consists in obtaining a cement sufficiently cheap for holding together the woody particles. It is evident, that such a composition can never possess any of the beauty of structure which is generally the principal one in rare woods, although a coarse imitation of this may be effected by particular combinations of different mixtures varying in colour.

Sir William Congreve's Moveable Ball Clock, invented by M. Serviere.—The cognoscenti in elegant mechanism, have long been in the habit of admiring a beautiful time-piece, which bears Sir W. Congreve's name, (but whether with or without his sanction, we know not,) in which the minutes are indicated by the descent of a brass ball, along a number of inclined planes, running alternately from right to left, and left to right, on the face of an inclined brass plate. When the ball reaches the bottom of the plate, after having described the last of the inclined planes, it releases a detent which tilts the brass plate, and inclines it in the opposite direction. The ball being now at the top of the system of inclined planes, commences its retrograde motion, and when it again reaches the bottom, the plate is again tilted at the opposite position. This clock was invented by M. Serviere, and is minutely described in various forms in a French work, which we have now before us, entitled, 'Recuil de Ouvrages Curieux,' &c. Lyons, 1719. In all these clocks, however, the ball is carried up by machinery from the bottom to the top of the inclined plane; whereas, in Sir W. Congreve's, the plane is moveable as above-described, which is a very important improvement.—*Edin. Journal of Science.*

Falling Star seen at Mid-day.—On the 13th August, 1823, at a quarter past eleven in the forenoon, as I was employed in measuring the zenith distances of the pole star, to determine the latitude, a luminous body passed over the field of the universal instrument telescope, the light of which was somewhat greater than that of the pole star. Its apparent motion was from below upwards; but as the telescope shows images in an inverted position, its real motion, like that of every falling body, was from above downwards. It passed over the telescope in the space of a second, or a second and a half, and its motion was neither perfectly equal nor rectilinear, but resembled very much the unequal and somewhat serpentine motion of an ascending rocket from the unequal burning of the charge, and the irregular reaction of the stream of air, issuing from it on the atmospheric air. It was thus evident that this meteor moved in our atmosphere, but it must have been at a considerable height, since its angular motion was so slow. This is perhaps the only instance in which a shooting star has been seen at mid-day in clear sunshine.—*Hansteen.*

Engraving on Zinc.—There has lately been published by Liske, the bookseller at Darmstadt, the first large work of which the plates are executed on zinc. It is a collection of monuments of architecture, which will consist of twenty numbers.—The work is done on zinc in the same manner as on stone, and the expense of engraving is thus avoided; hence the publisher has been enabled to sell the number, consisting of twelve folio plates, at five francs, upon common paper. In an economical point of view, therefore, this method deserves to be recommended. We see by the German Journals, that M. Eberhard, author of the collection in question, has recently published a pamphlet upon the use of zinc, with the view of replacing copper-plates, and lithographic stones, for engraving and designing.—*Edin. Phil. Jour.*

Locomotive Steam Carriage.—We understand, that two engineers (Messrs. Buntuls and Wilt,) have recently taken out a patent for a locomotive or steam carriage, considered by the patentees to be adapted as well to common roads as railways. The whole weight of a coach, with machinery, water, and coal, will not be above a ton heavier than the present stage coaches, while the power may be readily varied from two to ten horses, according to the inequality of the road. The speed at present contemplated is twelve miles per hour; and if the inventors (who we understand are ingenious and experienced practical engineers) have not, like many other projectors of the present day, deceived themselves, we may soon have to record an important application of the power of steam.

Seeing in Water.—In experiments made with the view of determining, whether or not we can see under water, some individuals maintained that they could see, while others with equal confidence asserted, that all around them was dark. In explanation of this seeming contradiction, it may be remarked, that in some individuals, owing to the delicacy of the conjunctive and lachrymal gland, the eyes remain shut when immersed in cold water: others whose eyes remain open, and who maintain that they see under water, actually do not see the forms of objects, only the light reflected from bodies having a bright surface as silver. The pearl fishers of antiquity are said to have used glasses of a particular kind, to enable them to see the pearl mussels. Instruments for seeing under water have been proposed by modern artists.

NOTICES TO CORRESPONDENTS.

A. B., Z. Z. Z., W. D. C., M. B., G. M., have been received. We would thank U. S. C. to inform us where the article he refers to appeared. V. who, in No. LXVI. inquires as to dressing webs in the act of warping, will find a letter at our Publisher's.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

Published every Saturday, by W. R. M'Phun, 155, Trongate, Glasgow, to whom Communications (post paid) must be addressed.

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THE GLASGOW

MECHANICS' MAGAZINE,

CONDUCTED BY

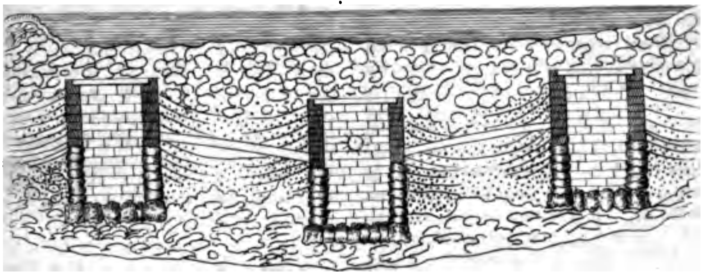
A Committee of Civil Engineers and Practical Mechanics.

> ——————— " I held it ever,
> Virtue and knowledge were endowments greater
> Than nobleness and riches: careless heirs
> May the two latter darken and expend;
> But immortality attends the former,
> Making a man a god ! "

No. LXX. *Saturday,* 30*th April,* 1825. Price 3*d.*

IMPROVED OLD WIVES FOR CHIMNEYS, NEW CHURN, &c.

Fig. 1.



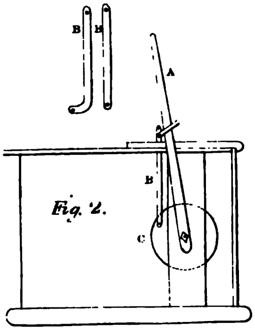


Fig. 2.

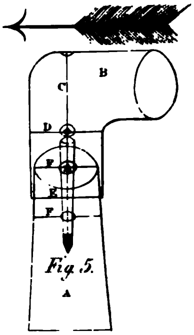


Fig. 5.

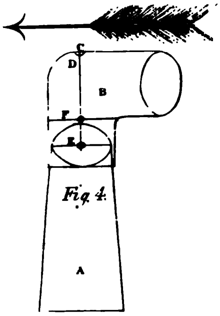


Fig. 4.

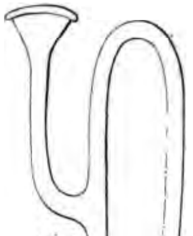


Fig. 3.

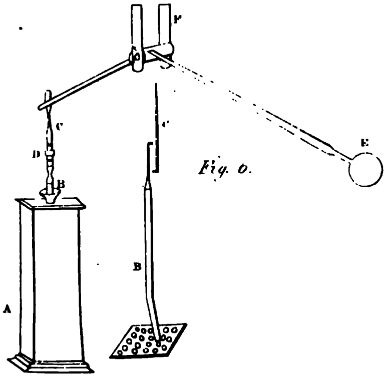


Fig. 6.

— Swan, Sc. —

IMPROVED OLD WIVES FOR CHIMNEYS.

GENTLEMEN,—According to promise, (Page 277, Vol. II.) I send an improved plan for the construction of old wives, &c. It will be necessary, in the first place, to give a description of the one now in general use, to show the difference more particularly. Fig. 4, is the best form for the cowl that I have seen, yet very few are made so; but whatever form the cowl may be, they are otherwise the same. A, is an earthen can, fixed with lime to the top of the vent. B, the cowl. C, a hollow centre, on which the cowl revolves, on the centre of the spindle D, which is fixed in the cross bar E. The cross bar F, is to keep the cowl steady in her revolutions.

It will be seen from this sketch, that as oil cannot be kept at the centres, the friction must be great, especially when it gets cloyed with soot. Now, the remedy generally adopted for this evil, as well as to satisfy the voracious disposition of quacks in smoke-doctoring, is to make them of materials too slight for wear; and, after all, you may see many of them standing unmoved by the highest winds that blow: consequently, doing more harm than good.

A better remedy will be found in fig. 5. A, is a cast or wrought iron can, or funnel, with a flaunch for fixing it to the vent with screwed bats and nuts. B, the cowl. C, the spindle, (fixed at the top, and by the cross bar D,) with a hollow centre in the down end, which turns in the oil tube E, on a centre raised one inch above the bottom, and guided by a brass bush, two inches from the top. A cover being fitted to the tube, with a hole in it to clean the spindle, and the cross bar D close on the cover, will prevent any soot from getting into it; the tube being filled with oil, and both bearings of the spindle being covered with it, must lessen the friction greatly. The centre being raised above the bottom of the tube, leaves a place for any sediment that may be in the oil, to rest in, clear of the centres. That the tube may be taken out and cleaned when necessary, it is fitted into the cross bars F, F, much in the same way as the muzzle of a musket into a bayonet.

This is no new invention, yet I believe it will be new to most of our smoke-doctors, and old-wife-makers, in this part of the country. It is not my own invention, yet I can claim some improvements on it, which are very much at your and the public service.

The oil tube and spindle is used in the same manner for smoke dispensers.—I am, yours, &c.

Y. S. D.

Gorbals, 1825.

NEW CHURN.

GENTLEMEN,—I send for your ably conducted Magazine, a plan and description of a churn, invented and used by Mr. Flockhart of Easter Craigduckie, which can be wrought much easier and sooner than the common plump churn. *Should you think it worthy* of a place in your work, I will feel your goodness in inserting it.

I am, yours, &c.

W. D. C.

West of Fife, 14th April, 1825.

A, (fig.6,) the churn. B, B, the churn staff. C, C, a rod, which attaches the churn staff to the lever. D, a slip to keep C into the churn staff. E, a ball to balance the churn staff, attached to the bottom of the handle that works the churn. F, posts suspended from the ceiling to where the churn staff is attached when used, and which can be removed at pleasure.

ON FILTERING.

GENTLEMEN,—Having noticed, in your Magazine of the 20th November last, a Correspondent wishing to know the best mode of filtering impure water, such as that of the Molendinar or Camlachie Burns, I hereby remit you the following method, the insertion of which will oblige, if found to deserve a place in your Magazine.

To form wells in the bed of the Burn, of brick or whinstone, square napped, and open built for about half way up; the rest being water tight, and flagged or covered over with cast iron covers, with Roman cement in the joints, connecting them together, above the open building, with cast iron pipes or small tunnels, to a well in the back, and placed so low as to admit a sufficient quantity of sand and gravel round them, with six or eight inches of coarse road metal over, to prevent the gravel from being washed away.

To preserve always a good head of water, it is only necessary to form the metal into a sort of basin, or throw a bar across the lower end.

With regard to this mode of filtering, there is evidently none less liable to choke up, or better adapted for the kind of place; as all the slime deposited is washed off, and any remarkable foulness carried away, before much can pass through the filters.

Fig. 1, represents a section of the plan.*

I am, yours, &c.

J. A.

Glasgow, 1825.

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* We have already, in No. LIX. page 7, Vol. III. given our own ideas on the subject of filtering. This, however, does not, in the slightest degree, prevent us from giving with pleasure the opinions of others on the same subject.

IMPROVED SYPHON.

Fig. 3, is an improved syphon, which, we think, might be very advantageously used if constructed on a large scale, for lowering the water in mill dams or canals. The improvement in the present syphon is, that the exhausting pipe is enlarged to the same diameter as that of the syphon, and its mouth is widened out to something of a funnel shape, as in the plate.

In putting it into action, the short arm is immersed in the water as in the usual manner, the bottom of the long arm is closed, the exhausting pipe is then filled with water by the funnel-shaped mouth. On the bottom of the long arm being opened, the water flows out, exhausts the air from the syphon, when the water, which is wished to be emptied, flows out in a continual stream.

IMPROVED PRINTING PRESS.

GENTLEMEN,—Excited by the inducement held out to mechanics, &c. at the end of the Numbers of your valuable Magazine, I herewith send a proposed improvement on the portable printing press. (Fig. 7. No. XLIX.) As exertion, to a considerable extent, must be required before an impression can be thrown off, the foot must be applied first in lifting the pressure board, then to the lever to give the pressure, and, thirdly, in lifting the pressure board again; by which process, before the operator could cast off 200 impressions, he would be in a state of exhaustion. These reflections has induced me to send the proposed improvement, which, if adopted, would save labour and facilitate the operation; and a boy, 8 or 9 years old, could give the required pressure with ease.

If, in place of the under levers, *m*, *o*, *i*, and *n*, (figure 7 of Plate No. XLIX.) a cylinder, (such as is used in copperplate presses,) with a lever attached, was placed under the table, supported by two upright posts, and the rods *f*, *f*, (No. XLIX.) attached to the levers *b*, *b*, were fixed by a small axle at each end of the cylinder, 1 or 1½ inches from the surface, by pulling the lever A, (fig. 2 of the present plate,) 1 or 1½ feet, would give the required pressure; and, on the cylinder returning to its place, the board would be raised, and remain so for the next impression. B, B, rods attached to the levers *b*, *b*, (fig. 7, No. XLIX.) one bent to come parallel to the other upon the end of the cylinder. C, the copper cylinder; and A, the lever attached to it, by which the power is obtained.

I am, yours, &c.

J. H. B.

Glasgow, 25th Feb. 1825.

ON THE IDENTITY OF THE NILE AND NIGER.

GENTLEMEN,—A querist, in No. LXIII. of your Magazine, wishes a solution, from ancient or modern authorities, of what he terms "a great problem of perplexed speculation,"—the identity of the Rivers Niger and Nile. Although, had he stated the fanciful opinions he alludes to on this subject, which he lately met with, and which caused his query, a more satisfactory answer might have been afforded to them, yet I shall state a few things which occurred to me on reading his query, which may be of use to him.

It is certainly a singular fact, that the question as to the sources of the Nile, which has divided the opinions of mankind for more than 2000 years, yet remains, in a great measure, a topic of speculation and conjecture. The direction in which it runs is, however, now satisfactorily ascertained; the more so, that its course, from *west* to *east*, as stated by Park, was the opinion of Herodotus, is supported by the authoritative names of D'Anville and Rennel, and has lately been confirmed by the information collected by Captain Lyon from the African traders. Assuming this as granted then, notwithstanding what we find in the 7th and 8th centuries maintained by the Arabian geographers, *that both rivers issued from the same lake, but that the Nile of the Negroes flowed westward, till it entered the Atlantic Ocean;* and, resting on the faith of ancient testimonies, it will be easily perceived, that these rivers are not distinct, but one and the same.

Homer distinctly mentions the sources of a river (ωκεανος) in Ethiopia, which word denoted, among the ancient Greek writers, any great river. Now, the Ethiopians mentioned by him, as his writings abundantly testify, were the Negro inhabitants of the western regions of Africa, where recent discoveries have ascertained that the sources of the Niger are to be found; consequently, the River *Ocean*, which the poet, in its lower course, calls Egyptus, and which is now the Nile, flowed through Lybia, the country of the Ethiopians, the western Negroes of Africa. Æschylus also mentions the River *Æthiops*, under such circumstances, as to render it impossible to apply it to any other than the Lybian Niger.

Herodotus declared that he was ignorant of the sources of the Nile, but correctly described the course of the Niger, when he affirmed, that the Nile passed through and intersected the whole of Lybia; for Park has clearly shewn, that the Niger is the only river which can be said to divide Lybia in the midst.

Besides all this, the Egyptians themselves uniformly concur in the identity of the Nile of western Ethiopia, and the Nile of Egypt; so that we may reasonably suspect, that the obscurity of terms, more than any other cause, has originated many apparent discrepancies on this subject. Should your correspondent wish to pursue this subject more in detail, he will find some useful hints upon it in a short Dissertation upon the Nile, by a Mr. Dudley.

I am, yours, &c.

Z. Z. Z.

Greenock, 18th April, 1825.

METHOD OF CONSUMING THE SMOKE OF STEAM BOILER FURNACES.—By Mr. Chapman.

Mr. Chapman's process consists in the introduction of air into the furnace beyond the fire; but he uses peculiar means of heating this air before it is introduced, and this renders the combustion of the smoke more ready and perfect. He says: "To heat the air before its admission into the furnace. This I do by casting the grate bars hollow from end to end, so that they form a series of parellel tubes, which open into two boxes, one placed in front, and the other behind the grate. In the front box, directly underneath the fire door, I make a register to open and shut, to any extent, at pleasure. The other end I connect with the brick work directly *under the fire bridge, which fire bridge I make double, with a* small interval between, say one inch; the interval to go across the furnace from side to side, and rather to incline forward, or toward the fire door, so as to meet and reverberate the smoke on to the ignited fuel in the grate, which causes it to inflame and to become a sheet of bright fire under the bottom of the boiler." Consequently, when the register is open, air passes along the bars of the grate, becomes heated in its passage, and is then thrown on the hot smoke, causing its inflammation and combustion.

Mr. Chapman found, that though his plan answered perfectly when the fire door was closed, yet it was inefficient when the door was opened for the introduction of coals; so much cold air passing in as to prevent the due effect of the arrangement. To obviate this, he fed his fire with fuel in a different manner. "I adopted a cast iron hopper above the fire door, with a type at the bottom that has two pivots on one side, and opens at the other; one pivot goes through the end of the hopper, and has a counter lever to keep the type shut, when a sufficient quantity of coals for a charge is on it. The top of the hopper is covered with a lid, which I shut down during the time of firing; then, by lifting the lever which opens the type inside, the coals slide down into the fire end of the grate bars, which is only the work of a moment. It is evident, that no quantity of cold air can thus get into the furnace; in fact, it is not possible for any person who does not see the operation of firing, to know when fresh fuel is added by looking at the top of the chimney. The smoke that issues is never more than a light grey, just perceptible, but in a general way is not seen at all."

The coals last admitted are allowed to lye until partially coked, and just before a fresh supply is admitted, are pushed farther along the grate by a tool for that purpose, which remains constantly in the furnace: it is merely a plate of iron, about four inches broad, and as long as the grate is wide: it has a handle long enough to be used with both hands, which comes through a hole in the bottom of the door: when not in use, it is drawn close up to the door. There is also another hole, about one inch in diameter, in the fire door to look through; a circular piece of iron hangs before it by a loose rivet.

The certificates of persons who have witnessed the effect of this application, speak to its entire success. Those who, previous to the erection of the engine, apprehended a nuisance, have been agreeably disappointed, smoke being seldom seen. On the application of fresh fuel, the smoke assumed the appearance of a light grey vapour, which, in a few seconds, became almost invisible. On opening the fire door in the usual way, dense black clouds of smoke rolled out of the chimney, but they ceased on closing the door again. An unlooked-for advantage also is, that the grate bars appear to last longer when thus constructed.—*Transac. Soc. Arts*, Vol. XLII. p. 32.

ON DRAINING OLD WASTES IN COAL MINES.

GENTLEMEN,—The query by "A Coal Hewer," in No. LXVIII. Vol. III. of your Magazine, must, for various reasons, be of very considerable importance, I therefore promptly endeavour to solve it; but, being unacquainted with coal working, and perhaps mistaking the queriest's description of the premises, I may have formed a wrong idea of the subject; I shall, however, according to the idea I have formed, propose two methods which *embrace all the requisites* of the *query.*

The first is to drive a horizontal bore or small tunnel from the new to the old mine, a little above the surface of the water, in which place a syphon of lead or other metal pipe; (wood might do, but it would be difficult to make it air tight;) this syphon will consist of a horizontal piece about the length of the said bore, or thickness of the partition which separates the new work from the old waste, with a piece joined to each end of it at a right or any other convenient angle, to form the legs; the length of the shorter will be regulated by the depth to which it is desired to drain the waste, and the other a little longer, more or less as circumstances will permit, and the lower end of it placed in a gutter or canal for conveying the water to the engine pump, which gutter must be cut as deep as to give the leg of the syphon placed in it a decided preponderance, so as it may operate; and let the diameter of the pipe of which the syphon is made, be such as to deliver just as much water as the pump at the pit is capable of discharging; but provided the pipe was large enough, the quantity could be regulated by a cock or valve, or simply by a plug. It is evident that this syphon, when once set agoing, would go on without farther trouble as long as there was any water in the waste within reach of the shorter leg.

The other method I propose is still less expensive, if indeed the expense of a small quantity of pipe is worth regarding in such cases. It is this: When the bore or communication between the new and old works is made as above described, let a groove or gutter be cut along it, a few inches below the surface of the waste water, taking care that the width and depth of this groove are such as to admit no more water than the pump can draw off, and as the run of water diminishes let the groove be gradually cut deeper, till the water is reduced to the desired level. This last method would evidently require more attention than the other, at least to effect the business in the shortest possible time; but by either of the methods, I presume it could be effected without danger to the workmen, without interruption to the work, and as soon as the engine was capable of draining it.

I am, yours, &c.

G. M.

Glasgow, 18th April, 1825.

LIFE OF ROBERT ADAM, THE CELEBRATED ARCHITECT.

[From Stuart's Dictionary of Architecture.]

Robert Adam was born at Edinburgh in 1728, and received his education at the University of that city. He was early distinguished for his taste in landscape drawing and composition, and at one period had devoted himself to that study, with a view of making it his future profession. He travelled to Italy in 1756, and was remarked for his assiduity in studying after nature, and making measurements of ancient Roman buildings. When he had visited almost every part of Italy, and drawn for some years its most remarkable antiquities, he felt, as all do, his knowledge of architecture was still imperfect.—He found *it necessary to* add the *observation of a private edifice* of the ancients to his study of their public works. This led him to the scheme of visiting the Emperor Dioclesian's palace at Spalatro in Dalmatia, that favourite building in which, after resigning the empire, he chose to reside. He knew, from the accounts of former travellers, that the remains of this palace, though tolerably entire, had never been observed with any accuracy, or drawn with any taste. He was likewise no stranger to the passion of that prince for architecture, which prompted him to erect many grand and expensive structures at Rome, Nicomedia, Milan, Palmyra, and other places in his dominions.—Adam had studied his public baths at Rome, one of the noblest as well as the most entire of all the ancient buildings, with no less admiration than care, which convinced him, notwithstanding the visible decline of architecture, as well as of the other arts, before the reign of Dioclesian, that his munificence had revived a taste in architecture superior to that of his own times, and had formed artists capable of imitating, with no small degree of success, the style and manner of a purer age: the names and history of those great masters are now unknown, but their works which remain merit the highest applause, and the extent and fertility of their genius seem to have equalled the magnificence of the monarch by whom they were employed.

Induced by these circumstances, he undertook his voyage to Dalmatia, with the most sanguine hopes, and flattered himself that it would be attended, not only with instruction to himself, but might produce entertainment to the public.

Having prevailed on Mr. Cleriseau, a French artist, from whose taste and knowledge of antiquities he was certain of receiving great assistance in the execution of his scheme, to accompany him in this expedition; and having engaged two draughtsmen, of whose skill and accuracy he had long experience, they set sail from Venice in July 1757, and in eleven days afterwards reached Spalatro.

The city, though of no great extent, is so happily situated, that it appears, when viewed from the sea, not only picturesque, but magnificent; as they entered a grand bay and sailed slowly towards the harbour, the marine wall and long arcades of the palace, one of the ancient temples, and other parts of that building, which was the object of his voyage, presented themselves to their view, and flattered him, *from this first prospect,* that his labour in visiting it would be amply rewarded.

"To these soothing expectations of the pleasure of my task," says Adam, "the certain knowledge of its difficulty soon succeeded. The inhabitants of Spalatro have destroyed some parts of the palace in order to procure materials for building, and to this their town owes its name, which is evidently a corruption of Palatium. In other places, houses are built upon the old foundations, and modern works are so intermingled with the ancient, as to be scarcely distinguishable. Assiduity, however, and repeated observation, enabled me to surmount these difficulties. Attention to such parts of the palace as were entire, conducted me with certainty to the knowledge of those which were more ruinous, and I was proceeding in my work with all the success I could have expected, when I was interrupted by an unforeseen accident.

"The Venetian governor of Spalatro, unaccustomed to such visits of curiosity from strangers, began to conceive unfavourable sentiments of my intentions, and to suspect that, under pretence of taking views and plans of the palace, I was really employed in surveying the state of their fortifications. An order from the senate to allow me to carry on my operations, the promise of which I had procured at Venice, had not yet arrived, and the governor sent an officer commanding me to desist. By good fortune, General Græme, (also a native of Scotland,) commander-in-chief of the Venetian forces, happened at that time to be at Spalatro on the service of the state: he interposed in my behalf, with the humanity and zeal natural to a polite man, and to a lover of the arts; and being warmly seconded by Count Antonio Marcovich, a native of that country, who had applied himself with great success to the study of antiquities, they prevailed on the governor to withdraw his prohibition, though, by way of precaution, he appointed an officer constantly to attend me. The fear of a second interruption increased my industry, and by unwearied application, we completed, with an accuracy that afforded them great satisfaction, those parts of our work which it was necessary to execute on the spot."

The result of this voyage was his determination to present the details of the palace of Dioclesian to the public; and before his departure from Rome, he had already carried his project partly into execution, by having several of the drawings he had made at Spalatro engraven by some Roman artists.

On Mr. Adam's return to England, he was introduced to the court by the Earl of Bute, and, through the influence of that nobleman, he received the appointment of architect to their Majesties.

In 1764, appeared his work on the Ruins of Spalatro, which he dedicated to the King. The engravings of views, plans, sections, and details, leave nothing to be wished for as architectural studies; and the style of the drawings, which was beautiful, being ably translated by the engravers, left every publication which had appeared in England at a great distance behind it. This splendid book placed him at the head of his profession; an eminence which it was his felicity to preserve to the end of a long and active life.

Being elected to represent the county of Kinross in Parliament, he resigned his office of architect to the King, but his practice and his fame continued to increase.

His life henceforward offers no *incident of importance.* His time was fully occupied in the practice of his profession; and no student ever laboured with greater ardour to acquire the mastery of his art than Mr. Adam did, from an enthusiastic love of it, after he had achieved both fame and fortune.—The year before he died, he designed eight public, and twenty-four private buildings. There are few instances of houses of any magnitude being erected in England, in his time, in which he was not either applied to for his opinion or for his designs. In Scotland he was without a rival in his practice.

The architecture of Greece, in his earlier and middle time, was little known, and its beauties were not appreciated. The course of his studies having been turned into the channel of Italian antiquities, the general style of his works was founded on an imitation of Roman architecture in its most florid period. Yet in many of his works, where the taste for exuberance of ornament, which he had imbibed, was checked either by the means of his clients, or the nature of the building, he produced compositions of great simplicity and elegance; and at almost all times he was happy in his outlines, and particularly in what are technically called his "sky-lines." The façade of the Register Office at Edinburgh is generally esteemed to be his finest public work; and, considering the date of its erection, the general current of taste at that period, it is entitled to all praise, and his fame as a classical architect may be fairly and safely rested upon its merits. The Infirmary at Glasgow has also been admired for its elegance, but probably its claims have been greatly over-rated—the whole composition wants *breadth.* The façade of the Edinburgh University is not the most happy of his designs, either for outline or imitation of the antique, yet some parts of its interior are equal to any thing he ever did.

Among his mansions, Luton is the finest. Here the patron and the architect seem to have been guided by one feeling; and here Adam's fine taste in ornament could be indulged without any violation of propriety. It may rank even now as one of the most finished and classical residences of its size in England.

He was sometimes called upon to give designs for castellated and abbatial mansions, but they were sad failures. His name must be added to the list of those architects whose fine Roman taste had nothing in common with an imitation of the barbarian structures of the middle ages.

Whether we estimate Adam by the number and importance of his works, or the influence which their style had upon the practice and taste of his contemporaries, he was, without question, the most eminent British architect of his time. It is to him we owe the introduction of that light and fanciful style of *interior decoration* which superseded the tasteless and clumsy manner of his predecessors, imitated from the buildings erected by the architects of Louis XIV. and XV. His merit here was the greater, as at this period there were few or no antique examples of *ancient domestic Roman ornament*, to which an architect could appeal as his authority, or follow as a guide. His style, therefore, ought not, in fairness, to be subjected to a scrutiny or comparison with that founded on an imitation of Greek buildings, of which little or nothing was then known, but with that of his contemporaries and his models. It will then be found abounding in beauties of a high and original kind, and which, it is hoped, will long preserve them as examples of a style of arrangement and decoration to which we would give our unqualified admiration, had they been the production of an architect of the lower Roman empire.

James Adam was brother to Robert Adam, and his colleague. Whatever merits he possessed as a designer, they are merged in the more brilliant reputation of his brother. He was better calculated for a builder than an architect, and his practice of becoming a *contractor* for carrying his own designs into execution, was an example, among one or two others, which has not only lowered the respectability of the profession, but has been the means of debasing the art itself.

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ON THE MANUFACTURE OF GLASS.

Glass is a combination of sand, flint, spar, or some other silicious substances, with one or other of the fixed alkalies, and in some cases with a metallic oxyd. Of the alkalies, soda is commonly preferred: and of the silicious substances, white sand is most in repute at present, as it requires no preparation for coarse goods, while mere *washing in water* is sufficient for *those of a finer* quality. The metallic oxyd usually employed, is litharge, or some other preparation of lead, as being the cheapest metal.

The silicious matter should be fused in contact with something called a flux. The substances proper for this purpose are lead, borax, arsenic, nitre, or any alkaline matter. The lead is used in the state of red lead; and the alkalies are soda, pearl-ashes, sea-salt, and wood-ashes. When red lead is used alone, it gives the glass a yellow cast, and requires the addition of nitre to correct it. Arsenic, in the same manner, if used in excess, is apt to render the glass milky. For a perfectly transparent glass, the pearl-ashes are found much superior to lead; perhaps better than any other flux, except it be borax, which is too expensive to be used, except for experiments, or for the best looking-glasses.

The materials for making glass must first be reduced to powder, which is done in mortars or by horse-mills. After sifting out the coarse parts, the proper proportions of silex and flux are mixed together and put into the calcining furnace, where they are kept in a moderate heat for 5 or 6 hours, being frequently stirred about during the process. When taken out, the matter is called frit. Frit is easily converted into glass by only pounding it, and vitrifying it in the melting pots of the glass furnace: but in making fine glass, it will sometimes require a small addition of flux to the frit to correct any fault. For, as the flux is the most expensive article, the manufacturer will rather put too little at first than otherwise, as he can remedy this defect in the melting pot. The heat in the furnace must be kept up until the glass is brought to a state of perfect fusion; and during this process, any scum which arises must be removed by ladles. When the glass is perfectly melted, the glass blowers commence their operations.

For the best flint-glass, 120 lbs. of white sand, 50 lbs. of red lead, 40 lbs. of the best pearl-ashes, 20 lbs. of nitre, and 5 oz. of magnesia; if a lb. or two of arsenic be added, the composition will fuse much quicker, and with a lower temperature.

For a cheaper flint-glass, take 120 lbs. of white sand, 35 lbs. of pearl-ashes, 40 lbs. of red lead, 13 lbs. of nitre, 6 lbs. of arsenic, and 4 oz. of magnesia.

This requires a long heating to make clear glass; and the heat should be brought on gradually, or the arsenic is in danger of subliming before the fusion commences. A still cheaper composition is made by omitting the arsenic in the foregoing, and substituting common sea salt.

For the best German crystal-glass, take 120 lbs. of calcined flints or white sand; the best pearl-ashes, 70 lbs.; saltpetre, 10 lbs.; arsenic, ½ lb.; and 5 oz. of magnesia. Or, a cheaper composition for the same purpose, is 120 lbs. of sand or flints, 46 lbs. of pearl-ashes, 7 lbs. of nitre, 6 lbs. of arsenic, and 5 oz. of magnesia. This will require a long continuance in the furnace; as do all others where much of the arsenic is employed.

For looking-glass plates, washed white sand, 60 lbs.; purified pearl-ashes, 25 lbs.; nitre, 15 lbs.; and 7 lbs. of borax. If properly managed, this glass will be colourless. But if it should be tinged by accident, a trifling quantity of arsenic, and an equal quantity of magnesia, will correct it; an ounce of each may be tried first, and the quantity increased if necessary.

The ingredients for the best crown-glass must be prepared in the same manner as for looking-glasses, and mixed in the following proportions: 60 lbs. of white sand, 30 lbs. of pearl-ashes, and 15 lbs. of nitre, 1 lb. of borax, and ½ lb. of arsenic.

The composition for common green window-glass is, 120 lbs. of white sand; 30 lbs. of unpurified pearl-ashes; wood-ashes, well burnt and sifted, 60 lbs.; common salt, 20 lbs.; and 5 lbs. of arsenic.

Common green bottle-glass is made from 200 lbs. of wood-ashes, and 100 lbs. of sand; or 170 lbs. of ashes, 100 lbs. of sand, and 50 lbs. of the lava of an iron-furnace: these materials must be well mixed.

The materials employed in the manufactory of glass are by chemists reduced to three classes, namely, alkalies, earths, and metallic oxyds.

The fixed alkalies may be employed indifferently; but soda is preferred in this country. The soda of commerce is usually mixed with common salt, and combined with carbonic acid. It is proper to purify it from both of these foreign bodies before using it. This, however, is seldom done.

The earths are silica, (the basis of flints,) lime, and sometimes a little alumina, (the basis of clay.) Silica constitutes the basis of glass. It is employed in the state of fine sands or flints; and sometimes, for making very fine glass, rock crystal is employed. When sand is used, it ought, if possible, to be perfectly white, for when it is coloured with metallic oxyds, the transparency of the glass is injured. Such sand can only be employed for very coarse glasses. It is necessary to free the sand from all the loose earthy particles with which it may be mixed, which is done by washing it well with water.

Lime renders glass less brittle, and enables it to withstand better the action of the atmosphere. It ought in no case to exceed the twentieth part of the silica employed, otherwise it corrodes the glass pots. This, indeed, may be prevented by throwing a little clay into the melted glass; but in that case a green glass only is obtained.

The metallic oxyds employed are, the red oxyd of lead or litharge, and the white oxyd of arsenic. The red oxyd of lead, when added in sufficient quantity, enters into fusion with silica, and forms a milky hue like the dial-plate of a watch. When any combustible body is present, it is usual in some manufactories to add a little white oxyd of arsenic. This supplying oxygen, the combustible is burnt, and flies off, while the revived arsenic is at the same time volatilized.

There are several kinds of glass adapted to different uses. The best and most beautiful are the flint and the plate glass. These, when well made, are perfectly transparent and colourless, heavy and brilliant. They are composed of fixed alkali, pure silicious sand, calcined flints, and litharge, in different proportions. The flint-glass contains a large quantity of oxyd of lead, which by certain processes is easily separated. The plate-glass is poured in the melted state upon a table covered with copper. The plate is cast $\frac{1}{2}$ of an inch thick, or more, and is ground down to a proper degree of thinness, and then polished.

Crown-glass, that used for windows, is made without lead, chiefly of fixed alkali fused with silicious sand, to which is added some black oxyd of manganese, which is apt to give the glass a tinge of purple.

Bottle-glass is the coarsest and cheapest kind: into this, little or no fixed alkali enters the composition. It consists of an alkaline earth combined with alumina and silica. In this country it is composed of sand and the refuse of the soap-boiler, which consists of the lime employed in rendering this alkali caustic, and of the earthy matters with which the alkali was contaminated. The most fusible is flint-glass, and the least fusible is bottle-glass.

Flint-glass melts at the temperature of 10° Wedgewood; crown-glass at 30°; and bottle-glass at 47°. The specific gravity varies between 2.48 and 3.38.

VARIATION OF BOILING POINTS.

It has been known for some time, that when certain kinds of extraneous substances are introduced into boiling fluids, considerable effect is produced upon the boiling point, vapour being formed either at lower points or with much increased facility. Thus, Gay-Lussac has shown, that metal filings thrown into water, heated in a glass vessel, lowers the boiling point of the water 2° or 3°; and M. Louth pointed out the effect produced, by putting platina wire, or slips of platina foil, into hot sulphuric acid, causing it to boil readily, quietly, and at lower points in glass vessels than it would otherwise do, the difference here being several degrees.

Dr. Bostock has observed a remarkable fact of this kind in the extent to which the boiling point of ether may be changed by the introduction of a small chip of wood, or portion of a quill or feather of any kind. Ether, in a glass vessel, boiled freely at 112°, and with difficulty at 110°. Employing another glass vessel, it would not boil till the temperature had attained 150°, and the latter point was retained in other vessels. Repeating the experiment in a new vessel, it boiled earlier than before, but the vapour was observed to come off from one point where some substance had adhered to the glass. This led to the introduction of a small cedar chip, when the wood was quickly covered with bubbles, and the ether brought rapidly to ebullition. In this way, ether boiled at 102°, which without the wood required 150°. The wood was not so effectual after some time as at first. When completely soaked with the ether, it sunk to the bottom, and the ebullition nearly ceased; a fresh piece renewed it. Fragments of broken glass lowered the boiling point considerably. A small piece of metallic wire or copper filing put into ether at 145°, caused a sudden and copious explosion of gas or vapour, and lowered the boiling point many degrees. Plunging a thermometer into the hot ether, caused a production of bubbles at a temperature many degrees below the boiling point, no thermometer being present; after a time the effect ceased, but the removal of the thermometer from the ether, and the re-immersion of it, produced a repetition of the effect. The cedar wood acted best when perfectly dry.

Alcohol of S. G. .848, boiled in a glass vessel at 182°, but by dropping in successive pieces of cedar wood, the boiling point was reduced as much as 30° or 40°. The boiling point of water, Dr. Bostock found, was altered 4° or 5° by chips of cedar wood, requiring a temperature of 217° when heated in a glass tube, by means of hot brine, but being brought down to the usual boiling point by the chips.

M. DUCOM'S CYLINDRICAL ARTIFICIAL HORIZON.

This ingenious instrument, which has already been put to the test of experiment by two able astronomers, Professor Simonoff and Baron Zach, has not yet been described by the inventor, but the general principle of the instrument may be deduced from two long dissertations upon it by Baron Zach.

The instrument consists of two parts, one of which is a copper disk of six inches in diameter, with three feet. The second part is a cylindrical cover or drum, which performs the part of the glass roof in the common horizons for sheltering the fluid from the action of the wind. From the middle of the first part or copper disk, there rises a hollow cylinder of white iron, 4½ inches high, and 2½ inches in diameter. Upon this cylinder, which is open at top, there is placed a small round disk of white iron, (or of boxwood, when mercury is used,) which goes into the top of the cylinder, but is prevented from descending by a ledge on which it rests. This disk contains the mercury, wine, or prepared syrup, which is employed. These cylinders are adjusted in such a manner, that the surface of the fluid is exactly 2½ inches above the first disk. On the copper disk are fixed two brackets, to which is fastened the cylindrical roof or drum. This drum, which is made of white iron, is 6 inches in diameter, and 2½ wide, and is so placed that its centre is in the surface of the fluid in the round disk. In the middle of the width of the drum, there are two bands of white iron, perforated by two circular openings, diametrically opposite to one another, and an inch in diameter, the one for letting in the incident rays, and the other for letting out the reflected ones. They have a circular motion by a rack and pinion on the surface of the drum, for the purpose of being adjusted to the height of the sun or the star.

When there is not much agitation in the air, two small funnels or truncated cones are placed in the small tubes in the circular apertures, and these have the effect of protecting the fluid surface from every agitation. When the wind is considerable, the funnels are kept on, and a small glass with parallel faces is placed at the end, by which means the incident rays are admitted. But if the wind is very high, the funnels are taken off, and a piece of wire gauze is placed in the tube. This permits the external air to be in regular communication with the internal air, which is favourable to the accuracy of observation.

ARTIFICIAL PRODUCTION OF PEARLS.

M. Gray, whilst examining a specimen of the shell *Barbala Plicata*, in the British Museum, observed on it several very fine regular shaped semi-orbicular pearls, of most beautiful water; and afterwards, on examining the collection of pearls, at the same place, he had an opportunity of observing on one of them attached to a fragment of the same shell, and cracked across, that it was formed of a thick coat, consisting of several concentric plates, formed over a piece of mother-of-pearl, roughly filed into a plane convex form, like the top of a mother-of-pearl button: the other pearls all appeared to be formed in the same manner, and on some pieces of shell, where the pearl had been destroyed or cut out, there was left a circular cavity with a flat base, about the depth, or rather less, than the thickness of the coat which covered the pearls; proving that the pieces of mother-of-pearl had been introduced when the shell was younger and thinner, and that they must have been introduced between the leaf of the mantle and the internal coat of the shell.

Hence, M. Gray was induced to expect that pearls of a very beautiful appearance and form for setting might be obtained with facility at home. He introduced similar pieces of mother-of-pearl into the shell of the *Anodonta Cygneus*, and *Unio Pictorum*; this was done without much difficulty, the valves of the shell being forced open to a moderate breadth, retained so by a stop, the mantle slightly turned down, and the pieces introduced to some little distance by a stick; the stop was then withdrawn, and the animals returned to their natural habitation: of the thirty or forty pieces introduced, only two were pushed out again, the rest being placed by the animal in a convenient situation. In several, afterwards destroyed, they were found near the posterior slope of the shell, where the pearls are situated in the barbala.

This plan of forcing the production of pearls by fresh water bivalves, M. Gray thinks is the invention of the Chinese. On cutting out the pearls, it would be necessary that the shell should be cut through, so that the mother-of-pearl button may be preserved in its place, for if the back were removed, as it would be were not the shell cut through, the basis would fall out, and then the pearl would be brittle.—*Ann. Phil. N.S.* ix. 27.

LETTERS AND QUERIES.

To the Editors of the
GLASGOW MECHANICS' MAGAZINE.

GENTLEMEN,—In answer to Liber, who, in No. LXVI. p. 126, Vol. III. wishes to know the best binding for books going to the East Indies, I beg to state that Russia binding is said to be the best. The smell of the leather is such, that no insects will go near it, as it kills them; and they are thus prevented from doing the books any injury. I have never been able to learn what it is gives the strong smell to the Russia; and I have in vain inquired at our English leather-dressers. They have never yet been able to ascertain the process for giving the smell, and consequently it has never yet been manufactured in Britain.

I am, yours, &c.
D. H.

Glasgow, 12th April, 1825.

GENTLEMEN,—If you or any of your numerous Correspondents can inform me of the best method of making shamoy leather adhere to silver, brass, &c.; to be used as keys to bugles, flutes, &c., they will much oblige

Your obedient servant,
M. B.

Glasgow, 19th April, 1825.

USEFUL RECEIPTS.

How to keep Muslins of a good colour.—Never wash muslins, or any kind of white cotton goods, with linen; for the latter deposits or discharges a gum and colouring matter every time it is washed, which discolours and dyes the cotton. Wash them by themselves.

To make Yeast for Bread.—Boil one quarter of a pound of good flour, one quarter of a pound of brown sugar, and a little salt, in two gallons of water for an hour; when milk warm, bottle it, and cork it close. It will be fit for use in 24 hours. One pint of it will make 18 pounds of bread.

Another Receipt.—To a pound of mashed potatoes, (mealy ones are best,) add two ounces of brown sugar, and two spoonfuls of common yeast. The potatoes to be passed through a cullender, and mixed with warm water to a proper consistence. A pound of potatoes will make a quart of yeast. Keep it moderately warm while it ferments.

ON PATENTS.

THE want of pecuniary means for carrying inventions into practice, has long been felt by humble talent; and many proposals have been made as to the best mode by which assistance could be rendered to those who may require it. The Association, of which the following is the Prospectus, we think must be of great use to the public in general, as well as to those who may have made improvements, but are unable to bring them into practical use by want of money. We trust the plan will prove successful.

BRITISH AND FOREIGN PATENT ASSOCIATION.

Capital £500,000, in 10,000 Shares of £50.

BANKERS.
MESSRS. DRUMMONDS.

THIS Association is formed for the desirable purpose of combining British and Foreign talent, and of concentrating into one focus—*the British Capital,* the combined Inventions and Improvements of "*all Nations,*" in the Arts, Sciences, Manufactures, Commerce, Navigation, &c. &c.

The primary object of this Association will be, to encourage and reward native talent—to animate and expand the powers of human intellect, as well by pecuniary aid as other means, and from which it is fairly presumed, a vast and permanent benefit will ensue to the British empire; the power and wealth of this country will be increased, and the dignity and welfare of society advanced; a new field will be opened to the most humble Mechanic, who may hitherto have deplored with anguish the want of means to reap the benefit of his invention; and the genius of elevated rank will find its interest best consulted by resorting to this Association; and it may appear incumbent on all classes to encourage an undertaking, tending to the perfectioning of human genius, and the promotion of science and industry. By the means of this National Association, both the public and the inventors will reap the important benefit of Patents now lying dormant in this and other countries, the projectors in numerous instances not having sufficient capital or connection to bring their inventions into effective use, as well as from other causes.

A fair and honourable remuneration will ensue to the subscribers, from the *purchase and re-sale of Patents;* and to calculate the profits upon a comparison of sums at which numerous patent rights have of late been *sold and re-sold,* would certainly appear to place them in an incredible point of view. At the same time that the public and the shareholders will be great gainers, this Association cannot in any wise interfere with, or affect private trade, but a fresh impetus will be given to the advancement of all useful inventions.

It is intended to establish a direct correspondence with all the principal towns and cities of Great Britain, the Continent, and America, and to afford pecuniary means (on proper investigation) for the inventors to proceed to England for the completion of their views; the remuneration to individuals will be liberal, and the sums thus realised will be again diffused throughout this country; and genius, hitherto buried in obscurity and oblivion, will have no more to lament the loss of many years of useless toil, labour, and expense.

The calls of this Association, *after payment of the first deposit,* of £1 per Share, it is anticipated will be of small amount, of which *six weeks'* notice will be given.

☞ We are happy to understand that MARK KIDD has followed the advice we gave him in a recent Number, and has commenced exhibiting his ingenious piece of workmanship to the Public. Surely what we have said in our previous Numbers on this subject, is enough to draw him visitors sufficient at least to recompense him for some share of the immense labour he has been at. "GENIUS," at all times, ought to be fostered; but when "IN OBSCURITY," too much cannot be done by those who have it in their power to assist it.

NOTICES TO CORRESPONDENTS.

A. B. and L. M'L. have been received. L. M'L. is very witty, as usual, in his first communication; but his wit has got the better of his observation. If he will read the conditions under which the competition must be made, he will find an answer to his question. We beg to hear oftener from him. *The information* wanted by Q. E. D. can only be supplied by personal application. We have "*reasonable cause*" *to give* in reply to his complaint, which may yet be forthcoming.

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THE GLASGOW MECHANICS' MAGAZINE,

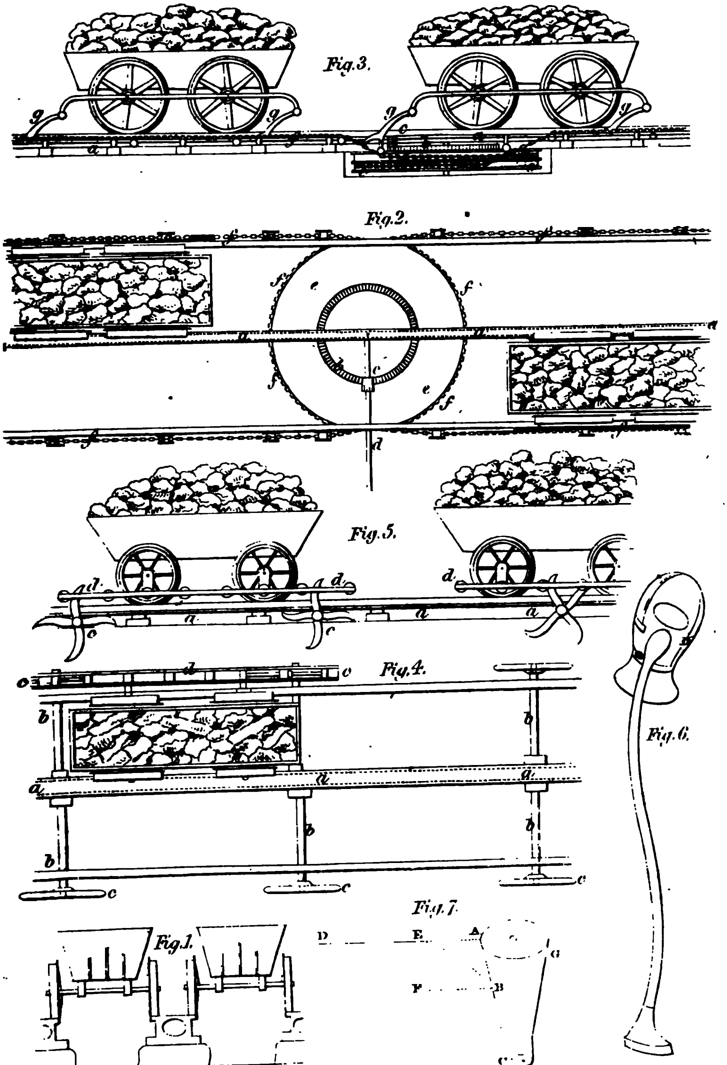
CONDUCTED BY

A Committee of Civil Engineers and Practical Mechanics.

................................" To know
That which before us lyes in daily life,
Is the prime wisdom."

No. LXXI. *Saturday, 7th May,* 1825. Price 3d.

ROBERTS' NEW INVENTED HOOD AND MOUTH-PIECE, &c.



VOL. III.

ROBERTS' NEW INVENTED HOOD & MOUTH PIECE.

In No. LXII. page 64 of the present volume, we gave a short notice from the Bolton Express, of an apparatus which had been invented by a person of the name of Roberts, then in Bolton, the object of which was the safety of life and property in cases of fire. This person has since gone to London, very strongly recommended by a number of gentlemen of rank and respectability in the immediate neighbourhood where he made the first experiment of his invention; and also from Insurance Companies, one of which, (the Manchester,) has liberally rewarded him with a purse of fifty guineas. The apparatus consists of a hood and mouth-piece, with a pipe reaching nearly to the ground, (fig. 6,) and having at its extremity a wet sponge, through which the air, which is always purer towards the ground in places which are on fire than in a higher region, is drawn; a decomposition of the air takes place in the sponge, and the air which is taken in becomes comparatively pure, enabling the operator, to remain in a foul atmosphere twenty times longer than a person without the apparatus. It is said that Roberts was once more than twelve minutes in an atmosphere from burning sulphur, wet hay, shavings, &c. at a heat of 200° Fahrenheit, whereas, without the hood, a man could not have survived twelve seconds.

We extract from the London Mechanics' Register, the following account of two experiments made by the inventor with the apparatus, in the area of the buildings of the London Mechanics' Institution.

First Experiment.

Among the spectators assembled upon this occasion, we observed Sir Robert Wilson, Dr. Birkbeck, Arthur Aikin, Esq. secretary to the Society of Arts; W. H. Pepys, Esq. F.R.S. late honorary secretary to the London Institution; Mr. Cooper, whose able lectures on Chemistry have afforded such general satisfaction; Mr. J. T. Barry, also an eminent chemist; Mr. Tatum, lecturer on Electricity, &c.; Robert M'William, Esq., Mr. Hubert, of the Sun Fire Office; Mr. Hodgskin; and several other gentlemen of distinguished scientific attainments.

A temporary room, 16 feet square, having been constructed under the direction of the Building Committee of the Institution, a fire was lighted in the centre of it about one o'clock; and in order to fill the apartment with dense and noxious smoke, a quantity of wet hay and shavings were placed on the fire, to which were added about two pounds of sulphur, and a shovel full of resinous cement. The vapour arising from these combustible substances were so insufferable noisome, that the spectators who stood near the building were obliged to remove to some distance, to avoid the small portion which escaped through the crevices. Roberts having put on his hood and mouth-piece, the construction of which we have already described, entered the room at exactly 28 minutes past one o'clock, at which time the temperature of the exterior atmosphere was 48°, and within the chamber 68°. The proximity of the thermometer to the building, caused it to rise to 53° as the experiment proceeded.

Roberts was furnished with three bottles filled with mercury, which were to be emptied at different periods, and the vapour which supplied the place of the mercury preserved for subsequent examination.

During the time the operator was confined in the apartment, he appeared to suffer no inconvenience, except from the heat, which became more and more intense, till the thermometer placed against the inside of the window reached 118°. He employed himself in supplying the fire with additional fuel, and as its occasional flashes for a few moments broke through the dense cloud which inveloped him, we could see Roberts walking about the apartment, and sometimes ascending a ladder to the top of the room, where the atmosphere was intensely hot. After the lapse of 20 minutes, a candle which stood near the window went out, and was soon afterwards melted by the increasing heat. The door being opened now and then for the purpose of supplying more combustibles, Mr. Bluett, keeper of the apparatus, and one or two of the workmen employed on the premises, entered the chamber on their hands and knees, but after remaining in it only a few moments, were driven out, apparently half suffocated by the fumes of the burning materials; though the atmosphere near the floor of the room was, comparatively, but slightly charged with the noxious vapours. One of the men who had attempted to breathe the pestiferous atmosphere, on emerging from its influence, expressively and elegantly observed, "*Its good luck for them as can stand it.*"

At four minutes past two, Roberts left the apartment at the request of his friends, having remained in it exactly 36 minutes. Upon removing the hood, he appeared in a strong perspiration, but was by no means exhausted. His pulse, which was at about 170, in a short time recovered its serenity; and after partaking of suitable refreshment, he felt no unpleasant effects from the ordeal he had passed through. He is 33 years of age, has been a miner from his earliest youth; and we understand, was once struck by the damp in a mine which he assisted in opening, about 200 yards below the surface of the earth, when he was 18 years old. He enjoys good health, and appears to possess a strong constitution.

The success of the experiment gave very general satisfaction to the company, and several gentlemen who had expressed doubts of the utility of the apparatus and the practicability of its application, were completely cured of their scepticism, and convinced of the importance of the invention.

Of the three bottles which Roberts had emptied of mercury in the closed chamber, in order that their gaseous contents might be removed for examination, one was opened by Mr. Barry, who afterwards communicated to Dr. Birkbeck the result of his analysis as follow:—

The phial was very damp internally, and contained a few drops of water. When opened under mercury at 53 deg. a quantity equal to one-fifteenth of the whole entered the phial. A portion of the gas being admitted into contact with lime-water, gave only the slightest trace of *carbonic acid;* other portions treated with nitrous gas indicated the presence of fully 19 per cent. *oxygen.* Hence barely two per cent. of the oxygen had disappeared.

The following valuable report was also transmitted to Dr. Birkbeck by Mr. Pepys, after his examination of the contents of another bottle.

"March 25, 1825.

"A bottle was filled with atmospheric air, which had been exposed to a temperature of 118 deg. and also to the combustion of a considerable quantity of deal shavings and other combustible substances, in the room where John Roberts was inclosed with his new safety hood. The volume of the bottle, with its stopper-in, was 315. Upon opening it under quicksilver, a volume equal to 32 entered. The barometer at that time was 29.83, thermometer 56.

"One hundred parts of this air was exposed to lime-water, in which it occasioned no precipitate, neither was there any absorption of the volume of air.

"No *carbonic acid.*

"It was treated with the sulphate of iron, charged with nitrous gas, and also with the green sulphate of iron, by which it was reduced to 80 parts.

"*Oxygen* therefore 20.

"The 80 parts were examined as to inflammable air or *hydrogen*, but not any was detected : therefore they must be considered as *azote.*

"Therefore the change on atmospheric air in the room was

Loss of oxygen...........1
Increase of azote.........1

"WM. HASLEDINE PEPYS.

"P. S. The slow combustion of *phosphorus* gave me also 80 per cent. of *azote* in the same air on the 26th March."

From conversation subsequently held with Roberts, it appears that the three bottles, of the examination of two of which the report has been given, were filled with air in three different parts of the room; one near the floor; another on a level with his mouth; and the third at the top of the room, where the temperature was nearly equal to that of boiling water. Hence it is probable, that the two bottles examined contained air from the lower strata, and that analysed by Mr. Pepys from the atmosphere nearest to the floor. Had this information been imparted immediately after the experiment, and the bottles marked by Roberts, to point out the places where they were filled, the examination would have been more satisfactory.

Second Experiment.

Several gentlemen who were unable to witness the former experiment, having intimated a wish for its repetition, Saturday, April 2d, was appointed for that purpose, upon which occasion a number of scientific individuals attended in the unfinished lecture room of the Institution, among whom we observed the learned President, with his son, Wm. Lloyd Birkbeck, Esq. and his brother, W. Birkbeck, Esq. Mr. Ogg, who recently delivered an able course of lectures on Geology to the Members of the Institution; Major General Ogg; Professor Van Breda, of Ghent; Sir Peter Laurie; Mr. Pettigrew, surgeon to His Royal Highness the Duke of Sussex; David Pollock, Esq. barrister, &c. &c.

The fire having been previously prepared, and an ample supply of combustibles placed in the temporary room used on the former occasion, Roberts put on his apparatus, and entered the apartment at eight minutes after two o'clock, at which time the thermometer on the outside stood at 54°. About three pounds of sulphur, in addition to other combustibles, were consumed during the experiment, the sulphur being placed in an iron pan, to prevent it from escaping combustion by falling to the floor of the apartment. The density of the cloud of noxious smoke, and the heat of the room increased as before, till the temperature indicated by the thermometers fixed in different places was as follows :—

At the ceiling,	158
In the centre,	101
Near the floor,	68

The heat of the apartment was not quite so intense as on the former occasion, but the vapour appeared to be more insufferably noisome. One of the workmen entered the room upon his hands and knees during the experiment, but on attempting to raise his head higher than about a foot from the ground, the suffocating sensation compelled him to quit the chamber with precipitation, after remaining there only two or three minutes. Roberts in the mean time traversed the room in an erect posture, supplied the fire with additional combustibles, and occasionally ascended the ladder, without feeling any inconvenience, except from the heat; and after having been enveloped in the Stygian atmosphere exactly thirty-nine minutes, and affording to every spectator a satisfactory demonstration of the efficacy of his invention, he quitted the apartment at thirteen minutes before three o'clock, and disencumbered himself of his apparatus in one of the lower rooms of the Institution. Mr. Pettigrew here examined his pulse, which was at 160, but subsided to 114 in about twenty minutes, and soon afterwards resumed its ordinary motion.

Roberts had been supplied with several bottles filled with mercury, in order that he might empty them in the room at stated periods, and preserve their gaseous contents for subsequent chemical examination. Three of these bottles were accordingly examined by Mr. Pepys, and it is a remarkable circumstance that they all appeared to be full of atmospheric air; as no mercury rose into them when opened beneath that metal, which, from the expanded state of the atmosphere of the apartment, must have been the case, if the bottles had been perfectly stopped. The air taken from the middle of the room, as to elevation, appeared to contain the largest quantity of *carbonic acid*, and the smallest quantity of *oxygen;* the following being the result of Mr. Pepys' very accurate analysis of that portion :—

Middle of the room,	2	carbonic acid.
	18	oxygen.
	80	azote.
	100	

In the course of the present week, Roberts has exhibited his apparatus to the Lords of the Admiralty, to whom he was introduced by John Barrow, Esq. the Secretary, in consequence of a letter kindly written to that Gentleman by Dr. Birkbeck. Their Lordships, we understand, were greatly surprised at the simplicity of its construction, and much interested by the unadorned description of its operation given by the inventor. Sir Samuel Hood, as well as other gentlemen, expressed a very favourable opinion of its merits.

The first experiment in Southampton-buildings has been noticed in terms of considerable approbation in the *Journal des Debats;* and as we feel a strong conviction of the great utility of the apparatus, we sincerely hope that the introduction of the unassuming inventor to the London Mechanics' Institution, will be the means of procuring efficient patronage to his invention, and ultimately secure for him that remuneration to which his native talents, unassisted by the advantages of education, have justly entitled him.

PATENT FOR AN IMPROVED RAIL-WAY.

To William James, *of Thaives Inn, in the City of London, Land Agent and Engineer, for his Invention of certain Improvements in the Construction of Rail and Tram Roads or Ways, which Rails or Roads are applicable to other useful purposes.*

[Sealed, 28th February, 1824.]

These improvements in the construction of rail-roads, or tram-ways, consist, first, in making the rails hollow, of whatever form circumstances may render most eligible, the object of which is to reduce the quantity of the metal in the rail, and at the same time to retain the required strength; secondly, in a method of producing a rail with a double road-way, to be firmly fixed as the centre of two lines of railway, by which contrivance a saving of one rail in four will be effected; thirdly, in affording the means of conducting water, gas, or other fluid, from place to place, through the hollow tube of the rail; fourthly, in employing the hollow rail as a trunk to receive ropes, chains, or rods passing from a standing engine, or other actuating machine, for the purpose of protecting these ropes or chains from external injury; and fifthly, in attaching to such rails or tram-ways, certain rods, wheels, and endless chains, for the purpose of drawing or propelling carriages along the said railway, which rods and wheels are to be actuated by means of a *stationary* steam engine or other stationary power.

The hollow rails are either to be cast in a mould, with a suitable core within, as castings are usually done, or welded, rolled, or otherwise formed, to the desired external shape, leaving a recess within; or they may be made partly of metal tubes connected to stone or wooden sides or bottoms, so as to leave the internal part hollow.—This contrivance of rendering the rails hollow, may be adapted to any external form of rail, and will be found to save a very great portion of the expense of metal, and yet retain the same degree of strength as if solid.

The construction of a double line of road with three rails only, is to be effected by making the middle rail of sufficient breadth to allow two carriages to pass each other. Fig. 1 is a section of two lines of road constructed of three hollow rails, that in the middle being broad enough to permit the two carriages to pass freely. This contrivance may be extended to a treble line of road, to be formed of four rails instead of six, and so on, by which means a great saving of expense will accrue both in the cost of the rail and the labour of laying down the lines. The advantages of the broad rail for reducing the number of lines, may be effected without adopting the hollow rail; these central lines may be constructed by joining together pieces of stone, which should be coated with plate iron or planks of timber.

The employment of such hollow rails for the passage of water, gas, or other fluid, from one place to another, may be advantageously resorted to, where such objects are desirable, without the expense of additional pipes or tubes; and these hollow rails may also be used with great advantage as trunks for conducting chains, rods, or ropes, passing from standing engines, or other machines employed for the purpose of drawing or propelling carriages along the tram-way, which chains, rods, or ropes would by that means be protected from the weather and other external injuries.

The fifth head of the invention respects the attachment of rods, wheels, gear, and endless chains, to such rails or tram-ways, for the purpose of drawing or propelling carriages thereon, by the agency of stationary engines.

One mode of affecting this purpose is shown at fig. 2, which is a plan of a double line of rail-road, and fig. 3 an elevation of the same. Along the central line *a*, *a*, which is a double rail, a series of rods extend: their extremities being connected together by coupling boxes, clutches, or other means, so as to enable the whole line of rods to turn as one axle, by the actuating power of a steam engine, or other moving agent, situated at the extremity, or in any convenient part of the line. This power may be applied immediately to the rods, or to the toothed wheel *b*, under the railway, which wheel being made to revolve horizontally, and taking into endless screws or pinions upon the rods, cause them to turn.

Below the rods the toothed wheel *b* is placed, which revolving horizontally, works into the pinions *c*, fixed upon the rod. Supposing the power of the engine to be communicated to the toothed wheel *b*, by means of a lateral shaft and pinion *d*, the revolution of the wheel *b* would cause the rods *a*, *a*, *a*, to turn, and other wheels similar to *b*, being situated at certain distances apart under the rail-way, would also be made to revolve in a horizontal direction, by means of the several pinions upon the central rods.

On the same axle, and under the toothed wheel *b*, is the large drum wheel *e*, which revolves with it; round this, and other similar drum wheels situate on the axles of the toothed wheels, at certain distances apart, the endless chains *f*, *f*, *f*, *f*, are distended, and by the revolution of the drums these endless chains are carried round, supported upon anti-friction rollers.

The endless chains being thus actuated, the carriages upon these roads are drawn forward by means of jointed arms *g*, *g*, extending from the sides of the carriages, which arms have claws at their lower extremities that drop into and take hold of the links of the chains, and thus, by the progress of the chains actuated as above described, the carriages are drawn or propelled along the rail-road; and in order to continue their progress past the breaks where the chains embrace the drums, the arms *g*, *g*, are set so far apart, that when the foremost arm falls out of action in passing the drum, the hinder arm has still hold of the chain, which continues to drive the carriage forward until the foremost arm has come into action with the next endless chain. Thus a succession of loaded carriages may be advanced along one line of the road, and others returned on the opposite line by the agency of the endless chains, drums, toothed wheel, and line of rods, actuated by a steam engine, or other moving power, situate at the extremity of the line of rail-road, or at any convenient places upon the line.

Another mode of impelling carriages upon a similar double line of rails, is proposed by the patentee, varying in a slight degree from the foregoing. Fig. 4 is a plan of such a line, and fig. 5 is a side view or elevation of the same; *a*, *a*, is a series of rods passing under the central rail, connected together by coupling boxes as above described. At suitable distances apart on these rails are bevelled pinions, taking into other bevel pinions at the inner extremities of the cross shafts *b*, *b*, and at the outer extremities of these cross shafts are rotatory cross arms *c*, *c*. On the outer side of each tram carriage, a sort of ladder *d*, *d*, is affixed, by arms extending from the axle trees, and thus by the rotation of the central rods *a*, the cross shafts *b*, with their arms *c*, are made to turn; and these cross arms *c*, taking into the ladders, and pressing against the rollers, of which the ladders are formed, by their rotation drive the carriage forward upon the rail-way.

Economy in the construction of rail-roads, has been the primary object of the patentee in these improvements; and from the immense capital proposed to be embarked in several projected lines, which the increased price of iron perhaps indispensably calls for, any invention which will materially diminish the weight of the rail, will, he considers, be of public benefit; that is, in case the rail-road system really possesses the advantages so confidently ascribed to it.

The first improvement proposed, *viz.* that of making the rails *hollow*, (independent of the additional strength *said thereby* to be acquired,) by the same weight of metal, will give a greater bulk, and consequently create a more solid base in the laying of the rail: a circumstance of some moment where the speedy passage of carriages is required.

The second suggestion, that of producing a double road on three lines, by an increased width of the centre line, (and forming a treble road-way by four lines, and so on,) is designed to be employed both as a double and a single road-way; that is, beside being adapted to ordinary tram waggons, it is also calculated for carriages of double width, loaded with cotton, wool, hops, hay, and articles for which the narrow single lines are but ill adapted.

The third improvement, that of furnishing the means of conducting water, gas, and other fluids, along a rail-road, through the rail itself, is intended to be employed when tube rails are laid by the sides of turnpike roads, for the purpose of conducting gas to light the said road in winter, and water to allay the dust in summer. By such a rail it is also contemplated to supply salt water for the Bathing Companies, from the coast, as well as of fresh water for every purpose, from a distance, to those places where it might be wanted. And as the mode of propelling carriages on rail-ways, herein proposed, will enable them to be drawn up a considerable elevation, it is also in the view of the patentee to conduct water, by means of these tubes, from springs on the high land for the purpose of turning over-shot water wheels upon his line of road, which water wheels shall give the rotatory power for actuating the shafts that propel the carriages as above described.

On the subject of the fourth and fifth improvements, which relate to the employment of a new mode or principle of propelling carriages along rail-roads, by fixed engines—it is suggested that, as doubts exist upon the propriety and advantage of employing locomotive high pressure steam engines, it may be prudent before subscribers entangle themselves with Parliamentary enactments, to consider whether these improvements may not have thrown some new light upon the subject. Two modes of applying the revolving rod as an actuating instrument for locomotion on rail-roads are pointed out, and other modifications would readily suggest themselves, if any of them should be found to succeed. The advocates for the rail-road system will silence the main arguments of its adversaries, by the employment of the *low pressure* steam engine, and even the *water wheel*, (where a sufficient head of water can be obtained,) as the actuating powers for turning these rods, to propel carriages along the roads, and with rails of only half the weight required for sustaining the ponderous locomotive engine. By this plan, with fixed engines, or water wheels, the road may be laid almost in straight lines, without much inconvenience from the inequalities of the surface. The great expense of tunnelling, cutting, and embanking, will be in a great measure avoided, and much valuable land preserved, besides which, the volumes of smoke constantly emitted, and noise of the locomotive engines as they pass, as well as the sad disfigurement of the country, which of themselves, are regarded as great nuisances, will altogether be dispensed with.

ON OVERSHOT WHEELS.

To the Editors of the
Glasgow Mechanics' Magazine.

Gentlemen,—Before discussing the principles of this machine, it will be proper to consider the following circumstances:—

If a weight, W, be raised by a given power, P, acting by the force of gravity, the greatest effect is produced when $W = P(\sqrt{2}-1.)$

Again, if it be required to find the greatest load raised by a given weight through a given height, in a given time, it will be found that this condition is satisfied when the weight raised at each ascent is about 5–8ths of the given weight.

But neither of these principles apply when a machine is put in motion by a constant and uniform supply of a moving power, such as water, which falls through a given height.

Suppose that this supply of water is employed to raise loads by means of a bucket and rope passing over a fixed pulley. If the fall were 20 or 30 feet, and a bucket were used of such a size as would contain all the water supplied in one day, the load raised might be almost exactly equal to the weight of the water in the bucket; for the time of descent would, in this case, be a whole day, and the height only 20 or 30 feet; and, therefore, the velocity, and, consequently, the accelerating force, and difference between the power and weight, would be very small. By an extension of this reasoning, it is evident that the weight raised might be as nearly equal to the weight of the water as might be required.

In the overshot wheel, if the water were to enter at the highest buckets, the velocity would go on increasing to infinity, were it not for atmospheric resistance and friction, if the water were always to enter the buckets with the same velocity as the wheel. But the water would require to fall from a greater and greater height, as the motion of the wheel increased, and if the height of the fall be given, this condition cannot be fulfilled. If the velocity of the wheel, therefore, increase to exceed that of the water, it will meet with a resistance from the water proportional to the square of their relative velocity.—This resistance, therefore, increasing as the square of their relative velocity, and the momentum of the wheel increasing only as its velocity, supposing the weight of water on it to be always the same, its velocity would at last be reduced to a uniform motion.

Let A B C G, (fig. 7,) be the double overshot wheel; the same reasoning applies to this wheel as to the common overshot wheel, while the investigation will be simple: let D E be the lead or canal. Let q be the quantity of water passing through the canal in one second, the canal being so wide at E that the velocity of the water may be very small.

Let $V =$ the velocity due to the height A C of the fall.
$v =$ the velocity of the wheel.
$h =$ A C.
$x =$ A B, the height through which the water must fall to acquire the velocity, v, of the wheel, the water entering the buckets at B.

Then $h : x = V^2 : v^2$, therefore, $x = \frac{h\, v^2}{V^2}$

and $v : h - x = 1'' : t''$, the time in which the point B moves from B to C.

Therefore, $t = \frac{h - x}{v} = \frac{h - \frac{h\, v^2}{V^2}}{v} = \frac{h}{V^2\, v}\,(V^2 - v^2)$ and this is also the time in which the water moves from B to C; and hence, if t were $=$ $1''$, the quantity of water in the buckets between B and C would be $= q$; if $t = 2$, this quantity of water would be $2\, q$, &c.; hence the weight of water between B and C is $= t\, q = \frac{q\, h}{V^2\, v}\,(V^2 - v^2 :)$ and if $m =$ the momentum of the wheel $m = \frac{q\, h}{V^2\, v}\,(V^2 - v^2)\, v = \frac{q\, h}{V^2}\,(V^2\ v^2,)$ and when the momentum is a maximum, $\frac{q\, h}{V^2}\,(V^2 - v^2,)$ or since q, h, and v, are given, $(V^2 - v^2)$ is a maximum. Hence, since $V^2 - v^2$ approaches to a maximum, the less v is, the momentum of the overshot wheel will become greater and greater, the less its velocity is. *

It may, however, be supposed, that if the water were always to enter at the top of the wheel, that the resistance arising from the buckets passing through the water, when their velocity is greater than that of the water, might occasion less loss of power than arises from the buckets above, the point B being empty. But if the velocity of the water entering at the top of the wheel be so small as to be neglected, the resistance will be as v^2, the square of the velocity of the wheel, which is proportional to the pressure of a column of water of a height due to the velocity v; but that height is just E F. Hence, if all the buckets contained water, the resistance against the wheel would just occasion the same loss of power that the want of water in the buckets above the point B causes, when the water falls, before entering the buckets, through the height E F, to acquire the velocity of the wheel.

It appears, then, from every point of view, that the smaller the motion of the overshot wheel, the greater is its momentum, and that when the velocity is very small, the momentum of the weight raised is almost exactly equal to v^2, the momentum the water would acquire in falling through the height of the water-fall.

It might be shown that the mo-

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* When the velocity is small, the wheel ought to be long.

mentum of the undershot wheel, when a maximum, does not exceed $\frac{4}{27}$ of that of the water.

I have not seen any investigation of the power of the overshot wheel, but the conclusion above is the same as that arrived at by Borda.

I am, yours, &c.

A. B.

Dollar, 22d April, 1825.

BRUNTON'S COMPENDIUM OF MECHANICS.*

We have already expressed our opinion of this little volume, in noticing the first edition, which appeared in the beginning of last year; and if any thing was awanting to prove the correctness of our opinion, it is supplied by the fact, that in so short a period a new edition has been found necessary. We again strongly recommend it to all our mechanical friends, as well calculated for operative mechanics, both from the clearness with which the doctrines are elucidated, the accuracy of the rules which it details, the variety as well as utility of the tables, and the cheapness of its price. It is the work of a Glasgow Mechanic, and is intended for the use of mechanics. No one can know so well what is useful or necessary in such a work, as one, himself daily in the same employment with those he writes for; because no one can know so well the difficulties which is constantly met with by mechanics in the course of their operations.

We mentioned formerly some defects in the work; and we are happy to perceive that a portion of them at least have been removed: we would have rejoiced had they been altogether. As it is, however, the work is most respectable, and does infinite credit to the industry and intelligence of Mr. Brunton. In order to show the manner in which the work is executed, we quote the method for ascertaining the Centre of Percussion, which is explained with much clearness and simplicity.

Centre of Percussion.—The centre of Oscillation or Percussion, is the point in a body revolving round a fixed axis, so taken, that when it is stopped by any force, the whole motion, and tendency to motion, of the revolving body, is stopped at the same time.

It is also that point of a revolving body, which would strike any obstacle with the greatest effect; and from this property, it has received the name of percussion.

The centres of oscillation and percussion are generally treated separately; but the two centres are in the same point, and therefore their properties are the same.

As in bodies at rest, the whole weight may be considered as collected in the centre of gravity; so in bodies in motion, the whole force may be considered as concentrated in the centre of percussion: therefore, the weight of the rod multiplied by the distance of the centre of gravity from the point of suspension, will be equal to the force of the rod divided by the distance of the centre of percussion from the same point. For example; the length of a rod being 20 feet, and the weight of a foot in length equal to 100 oz.; also, a weight or ball fixed at under end weighing 1000 oz.; at what point of the rod from the point of suspension will be the centre of percussion? *

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* Compendium of Mechanics; or, Text Book for Engineers, Mill-Wrights, Machine Makers, &c. &c. By Robert Brunton. John Niven, Jun. Trongate, Glasgow. Second Edition. 1825.

The weight of the rod is $20 \times 100 = 2000$ oz., which multiplied by half its length $2000 \times 10 = 20000$, gives the momentum of the rod. The weight of the ball $= 1000$ oz. multiplied by the length of rod $=$ 1000×20, gives the momentum of the ball. Now, the weight of the rod multiplied by the square of the length, and divided by $3 = \frac{2000 \times 20^2}{3}$ $= 266666 =$ the force of the rod, and the weight of the ball multiplied by the square of the length of the rod, $1000 \times 20^2 = 400000$, is the force of the ball: therefore, the centre of percussion $= \frac{266666 + 400000}{20000 + 20000}$ $= \frac{666666}{40000} = 16.666$ feet.

For another example; suppose a rod 12 feet long, and 2 lbs. each foot in length, with 2 balls of 3 lb. each, one fixed 6 feet from the point of suspension, and the other at the end of the rod; what is the distance between the points of suspension and percussion?

$$\begin{array}{rl}
12 \times 2 \times 6 = 144 & \text{momentum of rod.} \\
3 \times 6 = 18 & \text{momentum of 1st ball.} \\
3 \times 12 = 36 & \text{momentum of 2d ball.} \\
\hline
198 &
\end{array}$$

$$\begin{array}{rl}
\frac{24 \times 144}{3} = 1152 & \text{force of rod.} \\
3 \times 36 = 108 & \text{force of 1st ball.} \\
3 \times 144 = 432 & \text{force of 2d ball.} \\
\hline
1692 &
\end{array}$$

therefore, the centre of percussion $= \frac{1692}{198} = 8.5\dot{4}\dot{5}$ feet from the point of suspension.

As the centre of percussion is the same with the centre of gravity in the non-application to practical purposes, the following is the easiest and simplest mode of finding it in any beam, bar, &c.

Suspend the body very freely by a fixed point, and make it vibrate in small arcs, counting the number of vibrations it makes in any time, as a minute, and let the number of vibrations made in a minute be called n; then shall the distance of the centre of oscillation from the point of suspension be $\frac{140850}{n^2} =$ inches. For the length of the pendulum vibrating seconds, or 60 times in a minute, being $39\frac{1}{8}$ inches; and the lengths of the pendulums being reciprocally as the square of the number of vibrations made in the same time: therefore, $n^2 : 60^2 :: 39\frac{1}{8} : \frac{60^2 \times 39\frac{1}{8}}{n^2} =$

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* $a =$ 20 feet long.
$b =$ 100 oz. weight of a foot in length.
$c =$ 1000 do. fixed at end.

$$\frac{\frac{1}{3} a b \times a^2 + c a^2}{\frac{1}{2} a b \times a + a c} = \text{centre of percussion.}$$

$\frac{140850}{n^2}$, being the length of the pendulum which vibrates n times in a minute, or the distance of the centre of oscillation below the axis of motion.

There are many situations in which bodies are placed, that prevent the application of the above rule; and for this reason the following data are given, which will be found useful when the bodies and the forms here given correspond.

1. If the body is a heavy straight line of uniform density, and is suspended by one extremity, the distance of its centre of percussion is 2-3ds of its length.

2. In a slender rod of a cylindrical or prismatic shape, whose breadth is very small compared with its length, has the distance of its centre of percussion nearly 2-3ds of its length from the axis of suspension.

If these rods were formed so that all the points of their transverse sections were equidistant from the axis of suspension, the distance of the centre of percussion would be exactly 2-3ds of their length.

3. In an Isosceles Triangle, suspended by its apex, and vibrating in a plane perpendicular to itself, the distance of the centre of percussion is 3-4ths of its altitude. A line or rod, whose density varies as the distance from its extremity, or the point of suspension; also, *a fly wheel*, or *wheels in general*, is in precisely the same predicament as the Isosceles Triangle; *i. e.* the centre of percussion is distant from the centre of suspension 3-4ths of its length.

4. In a very slender cone or pyramid, vibrating about its apex, the distance of its centre of percussion is nearly 4-5ths of its length.

(See Edinburgh Encyclopedia; Article, Centre of Percussion.)

ON BELLS RINGING APPARENTLY WITHOUT A CAUSE.

GENTLEMEN,—It would oblige me if any of your ingenious correspondents could solve the cause of the following remarkable occurrence, that happened in my house within these three months back, and which has caused considerable inquiry and speculation in the neighbourhood.

I possess a house of four apartments in the second flat of a substantial tenement in Glasgow.—About three months ago, I had occasion to go from home for a day or two, and on my return found my family a good deal alarmed at hearing, the previous evening, the dining-room bell ring with considerable fury without any person being near it. I laughed at hearing the story, and paid little or no attention to it, when, the following afternoon, the same bell commenced ringing in my hearing, and appeared to be fully as loud as when the ropes were violently pulled. I still paid little or no heed to it, but allowed the bell to ring on, which varied at intervals of one and two hours, and the ringing continuing about the same length of time as when pulled by the ropes. The next afternoon the same ringing took place in the hearing of us all and two strangers, with this difference, that the parlour bell also occasionally rung. I may mention that these two bells are unconnected with each other, and hang on separate sides of the kitchen; the dining-room bell being immediately above the fire-place, about half a foot from the roof, and the parlour bell at the window, and no bell from the outer door. The bells continued ringing about six afternoons at intervals of one and two hours, when, one day sitting down to dinner and a stranger with us, the servant girl being then in the room waiting the table, the bell-rope next the window was observed by us all to start with the brass handle suddenly about a yard from its original position, as if suddenly affected by some shock; the bell did not then ring, nor was the other rope the least affected; the ringing of the bells, however, carried on as usual in the afternoon, and as violent as ever, when the sound became so troublesome and disagreeable, that towels were put round the bells to prevent us hearing them: the wires were frequently in this state heard to make a convulsive motion. I sent for a bell-hanger in the morning, who minutely examined them, and pronounced them complete and in good order; however, I caused the wires to be a little tightened, and the towels taken off, but in the afternoon, the same ringing carried on as violently and as loud as ever. The bell-hanger was again sent for next morning, and the bells taken down and every thing altered and made exceedingly stiff, and a new spring put round the dining-room bell, it being always the most noisy, and removed farther from the roof; but towards the afternoon the ringing was worse than at any previous time, when, getting out of humour, I went to the kitchen and cut the wires of both bells with a knife, about a foot from the spring; consequently, the wires fell away a considerable distance from their line along the wall. I considered every thing as now to remain quiet, and the outer door shut for the evening, when, singular to relate, the dining-room bell in this state, in the solid wall, without having any connection whatever with the wire, rung most furiously, and when I went to the kitchen I observed the little remnant of wire attached to the bell in motion, like the pendulum of a clock. I now considered it time to get these troublesome gentry taken down altogether. I therefore took the bells down myself, and to ease the mind of the servant girl, who did not sleep in the kitchen for nearly three weeks, they were banished to the cellars below ground, to ring and amuse themselves there. After remaining in the cellars above six weeks, the bell-hanger was again sent for, and the bells again put up as formerly: they have only rung twice about a month ago, one evening about 7 o'clock, continuing ever since perfectly quiet.

I have mentioned the above particulars to every person I could think capable of giving me any cause for the ringing, and I have been told it is electricity, by others galvanic attraction, and lastly, magnetism. I regret the bells lay so long in the cellars, but one of my family lying dangerously ill at the time, put it out of my head getting the bells put up again till health was restored. If it is actually electricity, galvanism, or magnetism, how is it that the bell-rope in the dining-room, made solely of worsted and cord, could be agitated without the wire or the bell at the time being at all moved, or even the other bell-rope? and how could the stump of the bell in the solid wall in the kitchen ring so furiously without being connected with any wire? and how should the bells in the same land not be affected in the same manner? an old lady lives immediately above, whose bells are similar to mine and never rung. I remain in the belief that the cause is not satisfactorily explained, otherwise I would not trouble you about such a trifling matter.

I am, yours, &c. A. B. T.

[From what we know of the respectability and accuracy of our Correspondent A. B. T., there cannot be a doubt as to the truth of the facts he states. We are, however, as much at a loss as he is to account for the phenomenon.]

LETTERS AND QUERIES.

CURE FOR THE ITCH.

Gentlemen,—In *this* corner of the terraqueous globe, we are not *very* subject to maladies of any species: to confections and confinement, which we believe to be the two grand *patrons* of all disorders, we are utter strangers; medical men, consequently, find no inducement to reside amongst us. *We* care not—*our* physician is no mercenary one. *His* unmeasured compound (the briny sea) we find a balsam for our every complaint! 'Tis both our prophylactic and our therapeutic!

This universal medicine was, however, found inefficient to cure a friend of ours, who had, for a long period, laboured under the very disagreeable distemper called the *Itch*. The *case*, Sirs, was, we presume, singular. By perpetual application of his *ten talents*, he had almost literally flayed himself alive! His appetite was not the least worsted or impaired, yet he was perceived to grow gradually so spare and pale, that his friends really dreaded the issue would prove fatal. At this crisis we corresponded with a Dr. Nelson of your city, who sent us a box of 'Antiscorbutic Ointment.' This invaluable ointment we at intervals applied for nine or ten days; after which, the disorder being eradicated, and the patient restored to consummate health, the application was deemed no longer requisite! This fact, Gentlemen, as sundry valuable members of society may be labouring under the same affliction, we deem it a piece of philanthropy to make public; and bearing, as we do, a *special* love to the household of mechanics, being ourself one, we judged your valuable Magazine the best herald to propagate the report of,

Your obedient Servant,

L. M'L.

Coll, April, 1825.

NEW AUGER.

Gentlemen,—Having seen in your valuable Mechanics' Magazine, No. LIX. page 11, Vol. III., a notice of a Mr. Church taking out a patent for a new kind of auger, which bores remarkably well, and sharps upon a common grinding stone, &c. &c., I beg leave to state that, about nearly three years ago, when working in a dock yard, I received a model of an augar from a ship carpenter, who brought it from some part of the continent of Europe, which answers the description of Mr. Church's auger, in so far as it is described. I made two of them at that time, and have occasionally made them since. I make them at present three different ways, and one is so simple, that any carpenter could make them for himself, and bore with them as well as with any shell auger. The other two bore well, and scarcely need any pressure upon the brace, and they all sharp to the very end, upon any common grinding stone. Now, if Mr. Church's augers be the same as mine, I hope his patent will not prohibit me from making them. But as I know nothing about patents, having been born and bred in a country place, a great man may take the advantage such as Dr. Church, who, I suppose, is the inventor of the new method of making types and printing, to which perhaps he has no more claim than myself. If you or any of your correspondents could give me any advice upon the subject in your Magazine, it would oblige a working mechanic,

R. T. A.

[We suspect that unless R. T. A. could establish the fact that he alludes to, if his augers are the same with Dr. Church's, he could be stopped making them. It is impossible, however, to give any precise answer, without being completely aware of the facts, which we are not.]

IRON CUTTING STEEL.

Gentlemen,—I have seen a curious invention noticed in your Magazine, (No. XXXVII. p. 124, Vol. II.) of iron cutting steel; and I am surprised that nobody has given any idea how it takes place. I sometimes turn a piece of iron, and as my lathe goes a little too quick, it is easy for one to observe the same phenomena which takes place sometimes in turning. It appears, then, that when a lathe, in turning iron, revolves too quick, the friction of the iron against the tool fires it, or heats it, and when it is hot, small particles of the ste adhere to it. By the quick revolution immediately cools, and therefore acts agai in its revolution upon the fired surface o the tool, which, by being hot by frictio is quite soft; so, in this manner, it is th steel that cuts itself, and not the iron tha cuts the steel.

R. T. A

USEFUL RECEIPTS.

Improved method of making Coffee.—From the highly fugacious nature of that part of coffee on which its fine flavour depends, a practice has become very generally adopted of late years, of preparing the liquor by mere straining. This method has not only the great defect of being excessively wasteful, but the coffee is likewise apt to be cold. Coction and the preservation of the fragrant matter are, however, not inconsistent. The union of these advantages is attainable by performing the operation in a close vessel. To obviate the production of vapour, by which the vessel would be ruptured, the boiling temperature must be obtained in a water bath. In my experiments I made use of a glass phial closed with a cork, at first let loose to allow the exit of the air. Cold water was put to the coffee. This process is equally applicable to tea. Perhaps it may also be employed advantageously in the boiling of hops, during which, I understand, that a material portion of their aroma is dissipated; as likewise possibly for making certain medical decoctions. This way of preparing coffee and tea presents various advantages. It is productive of a very considerable economy, since, by allowing of any continuance of coction without the least injury to the goodness, all the soluble matter will be extracted, and consequently a proportionably less quantity of them becomes requisite. By allowing the coffee to cool in the closed vessel, it may be filtered through paper, then returned into the closed vessel, and heated again, and thus have the most perfect clearness without any foreign addition to it, by which coffee is impaired.—*Ann. of Phil.*

NOTICES TO CORRESPONDENTS.

W. O., London—A. B.—F.—X.—G. K.—A Sailor—have been received. We also received G. M.'s last communication, which we intended inserting, but have somehow mislaid it; we wish he would send us another copy, and as we have a high respect both for him and for our friend in Dollar, we shall be glad to see he is less severe on that gentleman than he was in the communication we have mislaid. G. M. and W. C. are in the right, but there is a mode of telling a man he is wrong. We beg to remind them of the Latin adage, which we translate, "Firm in purpose, yet soft in manner." We cannot pretend to understand the communication of A. B., Rothsay; if he will write us more fully on the subject, and send us a drawing, we shall insert his communication, if there appears to be any thing new in it. We suspect Mr. Buchanan of Paisley either has not received our letter, or has forgot us. Are we not to hear from him? J. A., South Hanover-Street, has, we think, mistaken the purport of our note: we did not mean to say his communication was sent to us after our article on filtering appeared—for it was handed to us at the time he alludes to, along with a bundle of others, which we had not time to look particularly into—we merely meant to say, that although we had our own opinions on filtering, which we had expressed, we were quite ready to insert the opinions of others, however they might differ from us; and this we wish to be understood as to every subject coming within the scope of our work. Hydraulicus has mistaken the question of A Coal Hewer; and we suspect he has likewise mistaken the manner in which the Syphon acts. We have received a notice of the Dalkeith Mechanics' Institution, but it came too late for our Supplementary Number—it shall find a place on some future opportunity.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

"Be ye strong, therefore, and let not your hands be weak; for your work shall be rewarded."

No. LXXII. *Saturday, 7th May,* 1825. Price 3*d.*

MECHANICS' INSTITUTIONS.

So much has been said in our own Magazine, as well as in the other periodicals of the day, as to Mechanics' Institutions; and their great utility has been so repeatedly shown, and is so universally admitted, that it is now almost advocating what no one disputes, to say a word in their favour. Those whose mean and contracted minds would confine education to the rich alone, and who consider the educating of a poor man, as rendering him unfit for his situation, are happily now much diminished in number; and the few who cannot, or will not, be convinced, are at any rate silenced. The only attempt we have noticed to say any thing against them, is an article on Mr. Brougham's pamphlet, in the last Number of Blackwood: but the baseness of the spirit there evinced, and the folly of the reasoning the article contains, is so apparent as to require no refutation. Their principal argument is, that the people do not want instruction—that it is folly to give facilities for obtaining that for which there is no demand. The answer to this is, that even although there were no demand, (which, however, we deny,) the facility of obtaining it would create a demand. But there is a thirst for learning—a very ardent thirst—in the whole body of the people; and we hope that nothing will ever occur, which can have a tendency, in the smallest degree, to prevent these desires being gratified to the fullest extent.

Feeling, as we do, an intense interest in the success of these Institutions, we have been induced to give a short account of those which have been already formed throughout the country, so far as they have come to our knowledge. We think, that thus showing what has been done, may be extremely useful in keeping up and increasing the spirit which has led to their existence; and that it will lead to the erection of other Institutions on the same principles, in other places. The perusal of the following sensible observations on what ought to be considered as the ultimate object of Mechanics' Institutions, has given us so much pleasure, and really set their value in so clear a light, that we are induced to conclude these preliminary remarks with them. They are the production of a Norwich Mechanic of the name of Blake, and were originally written in the form of a letter to the Editor of the Norwich Mercury. Much of the letter related to local circumstances which cannot interest the general reader, and we shall therefore only give such extracts as appear to us to bear upon the great principle which we have advocated, and shall continue to advocate—THE ESTABLISHMENT OF MECHANICS' INSTITUTIONS.

"It ought to be shown that these Institutions, now spreading so rapidly over the face of Great Britain, are instituted solely for the benefit of the working classes, to advance the happiness of this part of the population of the country alone their purpose. The happiness of a people does not merely depend upon a stocking being made by machine rather than by hand—it does not merely depend upon the application of steam to a railway or spinning jenny—it does not merely depend upon the solution of a problem in mathematics, or upon the successful event of some chemical analysis; though these are agents, yet I contend they are very inferior agents to that intent, and are not the objects to be dwelt upon and considered as of primary importance in the discussion of the usefulness of a Mechanics' Institution. But the working classes are well aware to what they owe the welfare or the contrary of their condition—that it is governed by *the proportion borne by wages to the price of food and other necessaries of life*, requires but little ingenuity to determine at first sight, though it is somewhat more difficult to decide upon what regulates these latter. I do not now intend to plunge into the midst of such questions, a consideration of which may be reserved for another opportunity, but I may be allowed to state here the effects of these Institutions, on what so mainly and nearly affects us. When the severest labour meets with but a slight return, as has been the case in this country of late years, every nerve is strained and every resource is called into action to increase its reward, and in vain. Bound down by ignorance and prejudice, the labourer is prevented employing his exertions in the most profitable manner, and on the most productive objects; deprived of education, and, consequently, of all new ideas, he plods on in the old beaten track, unconscious of any other, and drags on a miserable existence, to be only relieved by the constant attendant on forced and unremitting labour—a premature death. Early marriages, another evil of the want of instruction, with their consequences, numerous and unhealthy children, weakening the body, as well as the spirit of their country, and the poverty-stricken labourer hourly sinks deeper into the most grovelling vices. That these are some of the consequences of ignorance and want of education has been lamentably demonstrated in the latter years of the history of the English labourer. To rouse him from this state, to the miseries of which long habit has made him callous, is the greatest aim of the philanthropical politician, and to this in a great measure have given way the useless animosities and absurd rivalries of the high and low factions. Lancasterian schools formed the first step, and by preparing that portion of the people who had the good fortune to be brought up in them, for the introduction of the means of a more extensive distribution of knowledge, of a more useful kind, by the establishment of Institutions of the nature of the one upon which the committee is now employed, have laid the sure and certain foundations for the future happiness, independence, and power, of the British mechanic.

"The strong prepossession formerly entertained by every class against the aid of machinery, as being prejudicial to the interests of the labourer, has in some measure subsided; this may be ascribed to two reasons;—the first, the general increase of information on every subject, and particularly in that branch of knowledge called political economy; to the study of which the talents of the most able men have of late years been directed, as a science promising more to promote the advancement of the human race than any hitherto discovered. The true principles of the creation, circulation, and consumption of wealth, are no longer unknown, and from them it has manifestly appeared, amongst other equally important truths, that the harm to arise from machinery to the poorer classes of the community is very imaginary. The second is experience, which has shown that an increase in the demand of labour has constantly and invariably followed the application of machinery to any new purpose, being a corroborative proof what, to all reasonable men was sufficiently proved before, the truth of the conclusion arrived at by the political economists. Even amongst the thinking part of our own class this prejudice has nearly disappeared—but amongst those unaccustomed to use their senses it exists with all its old and inveterate obstinacy. If any thing would do good, it would be a total eradication of it."

Speaking of the low rate of subscriptions to the Mechanics' Institution at Norwich, which had been mentioned as an advantage, as no one would have to depend upon the benevolence of the rich for the share he may hold in the Institution, Mr. Blake says:

"It is not for that portion of the community which having to submit to the most intense labour from twelve to fifteen hours every day, to furnish themselves and their families with the mere necessaries of life, to look upon these things with such indifference, but it becomes them as a duty to inquire into their nature, for the purpose of relieving their own hard and melancholy situation. The word charity did delude us for a long time, but year after year passed, and instead of bringing relief to us, it only produced fresh establishments by the benevolent, without the slightest decrease of the evil it intended to remedy; for as these charitable Institutions have multiplied, the more have we had to exert ourselves, the greater has been our share of labour, and a general decline in the rate of wages, except in some of the favoured districts of the country, has been the consequence and result—not of charities I admit, but of their total inefficacy as a means to produce that happiness which an accurate observation of the facts influencing the political state of society, and sound reasoning, have at length showed depends upon *circumstances only to be controled or obviated by our own exertions.*"

HISTORY OF MECHANICS' INSTITUTIONS.

ABERDEEN.—A very thriving Mechanics' Institution was begun more than a year ago in this place. On Tuesday the 27th of January, 1824, the first meeting was held, and at that meeting resolutions were entered into which formed the basis of the rules of the Institution. Lecturers were immediately appointed; and on Monday the 29th of May thereafter, the introductory lecture was delivered. Mr. Steele, who was some time lecturer in Paisley, afterwards in the Mechanics' Institution at Glasgow, delivered lectures last Winter on Natural Philosophy and Chemistry. The library contains 500 volumes; there is a valuable apparatus, and a lecture room for 600 students.

ALNWICK.—In this town, which contains only 5000 inhabitants, a Library and an Institution have been formed chiefly through the exertions of a Mr. Johnston, of which the Duke of Northumberland is patron, and Earl Grey president.

AYR.—No Institution has as yet been formed here: but we have seen a small pamphlet, written, it is said, by a mechanic, which proposes the establishment of an Institution, or at least a Library for Mechanics. We understand subscriptions are being raised for the purpose of establishing one or other of these objects, and we sincerely trust the design will not be allowed to fall to the ground. The writer of the pamphlet concludes his address with the following recommendation to the Mechanics of Ayr.

"You must either come forward now, and begin in good earnest to seek after useful knowledge, or allow yourselves to be marked out as second class animals—as ignorant of that knowledge that dignifies your nature—as inferior to tradesmen of the same condition in other places of the country. If a few of you can only be awakened, see that you make an attempt, if not to establish a Mechanics' Institution, at least to make an endeavour to form a Library, if you should only have in it the Edinburgh Review, the Scotsman newspaper, and the Glasgow Mechanics' Magazine, all of which contain an early notice of any discoveries of consequence, and are in many respects suited to mechanics, and whose pages breathe such a spirit as proves that they have the welfare of the working population much at heart."

BELFAST.—Meetings have been held, and strong exertions are made for the purpose of forming a Mechanics' Institution in this city.

BRISTOL.—A Mechanics' Institution is about to be formed in this city, and the promoters of the design have written to London announcing their intention, and requesting information on the subject.

CAMBERWELL, PECKHAM, and KENNINGTON.—A Literary Institution was opened in February last at Camberwell, under this name, at which an excellent lecture was delivered by the Rev. J. Peers, M. A.

CARLISLE.—The principles on which the flourishing Institution at Kendal was founded, have since been acted upon at Carlisle; and the fundamental one, which on every account is the most steadily to be kept in view, has been wisely recognized by a formal resolution, "that such Institutions are likely to be most stable and useful when chiefly conducted by the mechanics themselves;" and by a rule that two-thirds of the committee, consisting of twenty-one, shall be operative mechanics; the payment of five guineas, and a guinea a year for seven years, makes a life member; the others pay 8s. a year, and are admitted by the committee by ballot, and their sons or apprentices have all the benefits of the Institution. Above 300 volumes have been collected since November;

155 members have joined the Institution; a course of lectures on Natural Science has been delivered by Mr. Nichol; and the workmen who had attended it with increasing delight, presented him, at the close, with a silver box, of four guineas value, with twelve pounds inclosed.

CORK.—One of the most flourishing institutes, considering the short time that it has been formed, has been that of Cork; and we are truly happy to observe that it is becoming daily more popular. On the 26th Feb. a special meeting of the committee of the Cork Institute was held for the purpose of receiving a communication of great importance. After some preliminary business, the Mayor, who was in the chair, rose and said, that the period had arrived for making known to the meeting that he had the honour of a letter from his Grace the Duke of Devonshire, (cheers,) which would be read by the secretary, and which would best evince the feelings entertained by his Grace, for the welfare and happiness of the mechanics of this great commercial city, (cheers.) It was pleasing to be enabled to state, that the intention of soliciting his Grace's patronage did not originate in his communication; on the contrary, the letter only reached him (the Mayor) on Sunday last, and he understood that the proceedings of the committee to invite the Duke to become the patron were adopted some days previously. With this explanation, which he considered due to this exalted nobleman, he would request the secretary to read, and who accordingly read the following important communication :—

"London, Feb. 18, 1825.

"The Duke of Devonshire presents his compliments to the Mayor of Cork; he has seen in the Southern Reporter an account of the proceedings relating to the establishment of a Mechanics' Institute, and believing, from a knowledge of the great benefits derived from similar societies elsewhere, that it is likely to be highly advantageous to the class of persons for whom it is intended, he feels desirous, (should it not be contrary to the rules of the society,) to offer a donation. He will, therefore, be much obliged to Mr. Wrixon to inform him whether he can with propriety do so.

John N. Wrixon, Esq." &c. &c.

After the reading of this letter, several gentlemen addressed the meeting on subjects of local interest, and Mr. Deane, the treasurer, rose to detail the progress of the funds of the Institution, which was found to be very flattering. Thanks to his Grace the Duke of Devonshire for his gracious communication were then voted. As the remaining part of the proceedings possessed only local interest, we omit them.

DEVONPORT.—A public meeting was held at the Town Hall here, on Thursday the 10th March, 1825, for the purpose of taking into consideration the propriety of establishing a Mechanics' Institution, and of the best means to carry such measure into effect. The meeting was respectably and very numerously attended, there being, we should conceive, upwards of 700 persons present, most of whom were of the operative class, which such Institutions are more particularly adapted to benefit.

Mr. Burnet having taken the chair, he proceeded to address the meeting. He began by reading a calculation of the expense that was likely to ensue in establishing an Institution, and of the probable means that would arise to meet it. He first calculated £15 per year for the rent of the room to lecture in; £52 per year for a lecturer; he then enumerated several other items, making the total expenditure amount to £120 per year; to meet this, he considered that 300 operative subscribers, which was the very lowest that might be calculated on, at 3d. per week, would amount to £195, and which would leave a surplus of upwards of £70; he then contended, that many apprentices might be induced to join such an Institution at 2d. per week, which would considerably increase the means of the society; this surplus it was intended to lay out in the purchase of apparatus for the purpose of illustrating the lectures, and in a library for the perusal of the subscribers. The Chairman, after observing that he had no doubt but that many more operatives would join than he had now mentioned, and consequently that they would be enabled to expend more money in the purchase of apparatus, books, &c., read several extracts from Mr. Brougham's pamphlet, and said, that according to that gentleman's calculations, drawn from other towns where Institutions were established, the promoters of this measure might expect, from the population of these towns, that

1500 would join a Mechanics' Institution.—(Hear, hear, and applause.)—It was the intention, he said, when the Institution was formed, to have a meeting every week, and the lecturer, who should be elected by the Institution, should lecture once a fortnight; and the alternate week, a lecture they hoped might be supplied by some of the friends or subscribers, and thus native talent would be called into action. The principal object of the Institution, was the extension of mechanical knowledge among the operatives. After again speaking of its great utility, and of his hopes that it would be fully established, the gentleman read the first resolution, and sat down amidst loud applause.

Mr. Harvey (of Plymouth) next addressed the meeting, and at considerable length spoke of the great advantage that would arise from the establishment of the Institution. This gentleman also quoted largely from Mr. Brougham's pamphlet. He then observed that it would tend to make the operatives most regular in their habits, give them a love of science, and would prevent them from adjourning to the ale-houses, or any other places of idle resort. He concluded by seconding the first resolution, which was read from the chair, and carried unanimously.

Mr. Ramsey next addressed the meeting, advocating the measure most strenuously.

Mr. Elworthy, Mr. Sole, and Mr. Foster, severally addressed the meeting. The other resolutions were read and carried unanimously; the committee was named, and the list for subscriptions handed round. Mr. Harvey offered to the meeting *Smith's Wealth of Nations*, which was accepted with great applause. Mr. H. may thus be said to have commenced the Plymouth, Devonport, and Stonehouse Mechanics' Institution Library. Several gentlemen followed his example, and offered several sets of books, which were received with applause. Thanks were voted to Mr. Harvey for his exertions in the cause, and also to the Chairman for his conduct in the chair.

DUBLIN.—In December 1824, a Mechanics' Institution was formed at a meeting which took place on the 15th of that month, Michael Denovan, Esq. in the chair. A committee of management was formed, of which Messrs. James Ramsay and George Home, both Scotsmen, who had exerted themselves much in behalf of the undertaking, were members. The meeting was numerously attended by literary and scientific gentlemen belonging to the city, and by a great number of mechanics and artizans also belonging to the city. Resolutions were entered into, to procure a suitable library, a museum of models, an experimental laboratory, and all the necessary apparatus which such an Institution requires. These resolutions have since been carried partly into effect; and just now, the committee are advertising for a lecturer.

DUMFRIES.—A numerous meeting of gentlemen and tradesmen took place in the Trades' Hall of Dumfries, on the evening of Tuesday the 29th March, for considering the propriety of establishing a Mechanics' Institution in that town. William Thomson, Esq. the Provost, in the chair. Dr. Duncan of Ruthwell, explained at great length the nature and advantages of such an Institution; and a set of judicious resolutions for its regulation were read and unanimously approved of. Between thirty and forty gentlemen of respectability have already declared their intention of patronising the Institution; and a course of lectures on Chemistry is to be commenced by a gentleman well qualified for the undertaking, as soon as a sufficient apparatus can be procured.

EDINBURGH.—It is somewhat singular, that although there are many towns in Scotland, and some within a short distance of Glasgow, where hundreds of artizans are collected, yet twenty years elapsed before the example was followed, and men profited by an experiment, which, for so long a period, was constantly before their eyes, and attended with such remarkable success. It was not till the year 1821 that Edinburgh adopted the plan with some variations, a part of which appear to be improvements.

The promoters of the measure began by drawing up a short sketch of the proposed Institution, and causing it to be circulated among the principal master mechanics, with a request that they would read it in their workshops, and take down the names of such of the men as were desirous of being taught the principles of those sciences most useful to artizans. In the course of ten days, between 70 and 80 names were entered; and a private meeting was held of a few gentlemen who were disposed to encourage the experiment. These resolved to begin a subscription for the purpose. In April, 1821, they circulated a prospectus among the mechanics, announcing the commencement of a course of lectures on Mechanics, and another on Chemistry, in October following, with the opening of a Library of Books upon the same subjects, for perusal at home as well as in the room; the hours of lecture to be from eight to nine in the evening, twice a week, for six months; and the terms of admission to the whole, both lectures and library, fifteen shillings a year. A statement was then issued to the public at large, announcing the establishment of a "School of Arts," with the particulars of the plan; and so well was it received, by all classes, that in September, notice was given of 220 mechanics having entered as students, and such a sum having been subscribed by the public, as enabled the directors to open the establishment in October. When 400 had purchased tickets, the two courses of lectures were delivered by Dr. Forbes and Mr. Galbraith; to which one on Architecture and one on Farriery were added, with a class for Architectural and Mechanical Drawing during the summer recess.

The Mechanical lectures had hardly begun, when some of the students, finding the want of mathematical knowledge, proposed to form themselves into a class, under one of their own number, a joiner, who had agreed to teach them gratuitously the Elements of Geometry and the higher branches of Arithmetic. This suggestion was warmly approved of by the directors, and some assistance in books being given, thirty met once a week for Geometry, and once for Arithmetic; and adopting the plan of mutual instruction, they arranged the class in five divisions, each under the best scholar as a monitor, and going over in one night the lessons of the night before.—The number of this class being limited to thirty, those who were excluded formed another on the same plan, under a cabinet-maker, also a student of the School of Arts. The joiner's name is James Yule; the cabinet-maker's, David Dewar; and their successful exertions to teach their fellow-workmen are deserving of very great commendation.—Mr. Galbraith, the Mechanical Professor, adopted the plan of setting exercises to his pupils; and a list has been published of those who chiefly distinguished themselves by the number and accuracy of their solutions, being twenty-five persons.

The average receipts of the two first years were, from subscriptions, £448 yearly, and from the students £300.—The average expenditure was about £620, and a saving of £300 was made towards building a lecture-room. The expenditure includes, for furniture and apparatus, £216 a year; for books and binding, £110; and for expenses incident to the subscriptions, as advertisements, collections and meetings, about £70; leaving of current necessary expenses, about £220 only: so that if the extrinsic subscriptions were at an end, or were confined to the accumulation of a fund for building, the students could themselves carry on the establishment, and have a surplus of £80 a year for wear and tear, and increase of the apparatus and library; and if their contributions were increased to a pound yearly, which would probably make very little, if any, difference in the numbers of students, an additional £100 would be afforded for the better payment of the lecturers, or, if they continue satisfied, for the establishment of new lectures. This statement is important, as showing, that, in places where the rich are less liberally inclined than in Edinburgh, the same invaluable establishments may easily be formed and perpetuated, by a judicious encouragement given at first to the mechanics, and without the necessity of relying upon continued assistance from those who first promoted and aided them.

The number of students who attended during the Winter of 1823–24, amounted to 317.

The following is a statement of their different trades.

Joiners, Carpenters, and Cabinet-makers,	91
Masons and Marble-cutters,	24
Smiths, Engineers, and Iron Founders,	13
Printers,	8
Bookbinders and Stationers,	8
Tailors,	7
Millwrights,	6
Painters,	6
Farriers,	5
Plasterers,	5
Shoemakers,	5
Brass Founders,	5

Mathematical Instrument Makers and Opticians,	5
Bakers,	5
Weavers and Warpers,	5
Upholsterers,	5
Silversmiths and Jewellers,	4
Tinsmiths and Coppersmiths,	4
Tanners, Engravers, and Coachmakers, 3 of each,	9
Clock and Watch Makers, Architects, Hatters, Hair Dressers, Plumbers, Flax Dressers, Farmers, Brewers, 2 of each,	16
Teachers,	6
Pupils of Blind Asylum,	6
Shopmen and Merchants' Clerks,	54
Dentist, Musical Instrument Maker, Surveyor, Dyer, Gardener, Die-cutter, Turner, and Saddler, 1 of each,	8
No trade given,	7
Total,	317

See No. XXX. Page 8, Vol. II. of our Magazine.

FRANCE.—We are happy to state, that the present ruler of the French nation, has not only granted permission for the establishment of a Mechanics' Institute in Paris, but that he has also proposed that similar Institutions should be opened in Lyons, and at Rouen.—Now, as these are the most turbulent cities in France, we cannot help feeling that Charles X. pays a very high compliment to science, in proposing that two temples should be therein erected to it. This is a proof, at least, that he does not dread the diffusion of science and information; and we doubt not, that ere long the despotic monarchs of Russia, Prussia, and Austria, will also yield to the conviction that a state can only be permanent, when its supporters are science and wisdom.

A most eloquent and enlightened address was delivered by M. Dupin, at the opening of the Institution at Paris, which we shall take an opportunity of presenting to our readers in a future Number.

GLASGOW.—The history of the several Institutions which have been from time to time established in this city, for the purpose of advancing popular instruction, are already too well known to need much to be said about them. For the sake of uniformity, however, in the account of the different Mechanics' Institutions, we shall give a short abstract of the history of the rise and progress of Mechanics' Institutions in our city, which has the honour of having taken the lead in the great cause of instructing the people.

Andersonian Institution.—The founder of this Institution, Mr. Anderson, was, for upwards of 40 years previous to 1795, Professor of Natural Philosophy in the University of Glasgow. During this period, he always felt a peculiar pleasure in paying visits to the workshops of the mechanics and artizans of the city; and he thus had frequent opportunities of establishing his own theoretic views by seeing practical applications of them; and of communicating to the practical persons he was thus led among, the theories of the respective arts in which they were engaged. The benefit which this casual instruction produced, in all likelihood, suggested the idea which he afterwards followed up of opening a class, where science and philosophy could be explained in a familiar and popular manner to the public in general, instead of being exclusively taught to the students at the College. He accordingly opened a class on the Tuesdays and Thursdays, to which the public were admitted. Many availed themselves of this opportunity of improvement; and in a short time, within the walls of the College of Glasgow, there was a large class of operatives and artizans receiving instruction in science, which had hitherto been to them quite inaccessible.

At his death, Professor Anderson left a will, by which he bequeathed his property to the public for the good of mankind and the improvement of science; and in consequence of it, the Institution which now bears his name was opened in 1796. In No. LV. pages 412–414, Vol. II. of our Magazine, we have given extracts of the will, in terms of which the Institution was founded: and by this it is apparent, that he was still desirous that a popular course of lectures should be delivered to the public.

Dr. Thomas Garnet was the first Professor, and he continued to deliver lectures in the buildings in John-Street, which had been purchased by the managers for the Institution, to his own honour and to the satisfaction of his pupils, until 1800, when he was appointed first Professor of the Royal Institution of Great Britain, which had been then just founded in London.

Dr. George Birkbeck was appointed Dr. Garnet's successor; and, in addition to the regular lectures, the new Professor, in furtherance of the views of the enlightened founder of the Institution, agreed to deliver, *gratis*, an additional weekly lecture calculated chiefly for operatives. This weekly lecture, in addition to the regular courses of Natural Philosophy and Chemistry, has been continued ever since. About two years afterwards, some alterations were made, and a small fee of 5s. was taken for each ticket.

In 1804, Dr. Birkbeck resigned his situation, and Dr. Ure, the present Professor, was appointed his successor. Three courses of lectures are at present annually given, *viz.*—one on the popular illustrations of Physical Philosophy; it is attended by ladies and gentlemen, the average number of auditors being about four hundred. Another course, in Chemistry; the object of this course is chiefly to develope the connection of this science with the useful arts, and to point out its numerous applications to their improvement. The third, and perhaps most useful course of lectures, is addressed exclusively to the manufacturer and operative artizan. In this course, the elements of Mechanical Science are explained in the simplest and most impressive manner. Various other courses of lectures have been delivered at different times by other persons, and on other subjects. The Institution is possessed of a most magnificent apparatus, and museum; and besides a general library, has one for the use of the mechanics, which contains about 1500 volumes.

Mechanics' Institution.—This Institution arose out of the one which we have just described. The members of the Mechanics' Class in the Andersonian Institution, had been for sometime in the habit of remaining in the library-room, on the nights when they came to exchange their books, for the purpose of discussing the subjects on which they had been reading; and thus an extraordinary impulse was given to their spirit of inquiry. The library committee too, being chosen by the whole body, became, in some sort, its representative, and claimed to interfere in the management of the Institution. It soon happened that some of their suggestions were not attended to, and a difference, at first to be regretted, led to consequences highly beneficial, for a great number seceded from the lectures, and formed the second Institution, under the name of the "Glasgow Mechanics' Institution." It is entirely under the management of the mechanics themselves; and has been successful beyond all expectation. On the 5th of July, 1823, the first committee of management of the new Institution was appointed; and these gentlemen immediately proceeded to provide a hall for the lectures, and to make arrangements with regard to the library. A hall was taken for seven years at the yearly rent of £42 sterling; and alterations which cost about £130 were made upon it, by which it was rendered the most extensive and commodious lecture-room in the city. Mr. Steele was engaged as lecturer on Mechanics and Chemistry, in terms of a resolution passed at one of the meetings of the whole members, for which he was to receive £150 per annum. Mr. Steele concluded the first course in May, 1824, which was delivered to a class of nearly 1000; and in consequence of the receipts being so much beyond the expectation of the committee, they recommended the members to vote that gentleman £50 farther. Mr. M'Fadyen delivered a very interesting course on Natural History. In July, 1824, Mr. Mackie began a course of lectures on Mathematics, which he finished much to the satisfaction of his pupils. In the month of August, a course of lectures was likewise commenced on Popular Anatomy by Dr. Brewn.

Mr. Steele, owing to some difference with the class, was not re-elected lecturer on Mechanics and Chemistry; but Mr. Longstaff was appointed, and last winter he delivered a course of lectures on the same subjects with Mr. Steele, and Mr. M'Fadyen repeated his lectures on Natural History. The Institution is at present in a very flourishing condition, and has been incorporated by the Magistrates, who have granted a charter and a seal of cause, incorporating the members. The museum is daily increasing, and the library is now very extensive.

The Gas Workmen's Institution.—Out of these public associations has arisen one upon a more confined but most useful plan, applicable to every large manufactory. The Gas Light Company's men, between 60 and 70 in number, have formed themselves, on the suggestion of Mr. J. Neilson the manager, into a society for mutual instruction; laying by a small sum monthly, they have collected about 300 volumes, and the Company giving them a library room, which they light and heat, the men meet every other evening, to converse upon literary and scientific subjects, and once a week to lecture; any one who chooses, giving a fortnight's notice that he will treat on some subject which he has been studying. The books are of all kinds, with the exception of theology, which, from the various sects the men belong to, is of necessity excluded.

In No. LIII. page 376, Vol. II. a

very particular account of this Institution, from the pen of D. Bannatyne, Esq. will be found; and it is with pleasure we add, that this Institution continues most prosperous.

University Printing Office.—On the plan of the Gas Workmen's Institution, one has been commenced among the workmen employed by Messrs. Duncan, at the University Printing Office. We have not yet obtained the particulars of it; but we understand that an account of the whole, with the introductory address, will shortly be published.

GREENOCK.—The Institution of Arts and Sciences in this place, took its origin two years ago, in consequence of the efforts of several patriotic individuals, to establish, on the spot, a school which would afford to the community the same facilities which the people of Edinburgh and Glasgow then possessed, of acquiring, at an easy rate, the useful sciences. The projectors of the measure called a public meeting, and had the satisfaction to find the scheme universally approved of. At that meeting, twelve directors were appointed to manage the Institution; and though late in the season, it was resolved to endeavour to raise funds to purchase a small apparatus and a supply of books. The public were not slow in affording them assistance; and a very considerable sum was subscribed, and expended on the library and apparatus. At the same time, the books purchased with £200 left by the late JAMES WATT, for the purpose of purchasing useful authors for the mechanics of Greenock, were appropriated to the use of the Institution. The funds, however, were inadequate to authorise the directors to venture on engaging a hired lecturer this year; and had not Mr. William Heron offered his assistance at that juncture, one season of instruction would have been lost to the Institution. This gentleman conducted the first course, comprising a series of lectures on Chemistry and Natural Philosophy, with credit to himself and advantage to his pupils; and, at the end of the season, the students, upwards of 200 in number, in testimony of their sense of his merits, presented him with a piece of plate. The class this summer was almost exclusively attended by mechanics, who paid each a fee of 5s. to entitle them to attend the lectures, and to the use of the library.

In December last, the second course was commenced with twelve lectures on Natural Philosophy, *by Mr. Murray*; and from 1st January till this period, a twice-a-week lecture has been given on Mechanics or Chemistry. The mechanical lectures were conducted by Mr. John Fairrie, and illustrated by a well-selected series of models, some of the most expensive of which Mr. Fairrie produced at his own cost. The chemical department has been brought forward in a series of thirty-five lectures, by Dr. James Kirk. In this very extended course, it has been the study of the lecturer to avoid the flash and glare of useless experiments, with which time is too often wasted, and to confine himself to illustrations and experiments having a direct reference to useful purposes. The course has been illustrated also, in the proper places, by a good collection of minerals. Upwards of 300 pupils attend the class, more than 200 of whom are mechanics. In regard to regularity, attention, and every point of respectable conduct, it is impossible that any body of students could have behaved better than they have done; and every stranger who has visited them, has agreed in the warmest admiration of the correctness of conduct as a class, which so peculiarly characterised them. The class have this season subscribed a considerable sum to purchase a testimonial of their respect and gratitude to Mr. Fairrie, whose labours as the Secretary of the Institution, and in conducting the mechanical course, they thus wish to show their sense and approval of. At a general meeting of the class, it has also been unanimously agreed to appoint a committee of twelve of their number to wait on the directors, with a request that Dr. Kirk may be appointed lecturer on Chemistry to the Institution; and to express to the directors, sentiments of high respect and approbation with regard to that gentleman's talents in general, and as a public teacher of science. Since the original subscription, the public have not been applied to for any further aid; and the fees of this season were 10s. 6d. for masters and others, 5s. for journeymen, and 2s. 6d. for apprentices.

HADDINGTON.—An excellent plan was about ten years ago adopted by Mr. S. Brown of Haddington, for instructing the towns and villages of the county of East Lothian, in succession, by means of the same books. It began with only a few volumes; but it now has 19 *Itinerant Libraries* of 50 volumes each, which are sent round the different stations, remaining a certain time at each. For these there are 19 divisions, and 15 stations; 4 divisions being always in use at the chief town, and 2 at another town of some note. An individual at each station acts as librarian. There are 700 or 800 readers, and the expenses, under £60 a year, are defrayed by the produce of a sermon, the sale of some tracts, and subscriptions, in small sums, averaging 5s. (See Vol. I. page 271, of our Magazine.) Out of the Haddington Itinerant Libraries, there grew a School of Arts in 1821, established by some tradesmen who, several years before, had formed a society for scientific discussion; and lectures on mechanics, chemistry, and the mathematics, have since been successfully delivered to the workmen by Dr. Lorimer, and Messrs. Gunn and Cunningham.

The first report of this Institution will be found at page 32, No. XXXI. Vol. II. of our Magazine.

HAWICK.—This town has not above 4000 inhabitants; yet a mechanics' society and library has been established here for some time; and Mr. Wilson, from Edinburgh, went thither in the autumn, and delivered a course of lectures on Natural Philosophy to 200 artizans.

HUDDERSFIELD.—No Institution has as yet been established in this place; but we learn with pleasure, that measures are adopting for doing so immediately. (See No. LXVI. page 128 of our present volume.)

HULL.—A meeting of mechanics took place in February last at Hull, to take into consideration the practicability of establishing an Institution for that place, when it was unanimously resolved to attempt the accomplishment of so desirable an object, and a provisional committee was chosen to proceed forthwith.

INVERNESS.—On Friday, the 11th March last, a meeting was held in the Town Hall, for the purpose of establishing an Institution for the promotion of science and literature, and for the establishment of a museum in that city. The meeting was very numerously attended by the gentlemen of the neighbourhood, and many of the clergy were present: and, at the same time, letters were read from many eminent persons approving of the measure; among others, from His Grace the Duke of Gordon, Sir Geo. Stewart M'Kenzie, Bart., Sir Thos. Dick Lauder, Bart., and Dr. Hibbert, Secretary to the Society of Scottish Antiquaries. It is to be called "The Northern Institution for the Promotion of Science and Literature." A committee has been appointed for the purpose of forming regulations; and Mr. George Anderson, Solicitor, who exerted himself greatly in bringing about the meeting, was appointed Interim Secretary.

IPSWICH.—A Mechanics' Institution has been established in this place, which is proceeding with great success and energy, notwithstanding a base attempt of some busy fools to decry it, on the ground of its having a political tendency. Every body knows that there are fools in Ipswich, but we never imagined to have found any so completely lost, as to object to the formation of a society, which, from its nature, has nothing to do with politics, merely because it might become political. We will tell these Ipswich fools, and the observation will hold good every where else, that the first rule of the Mechanics' Institutions is, to supply the members with good books—good books make good men, and good men make good politicians. If, therefore, the members of Mechanics' Institutions ever dabble in politics, it will be on the side of the king and the constitution, and we do not see that the possibility of such a circumstance can justify a resistance to their formation.

KEIGHLEY.—An attempt has been made to establish a Mechanics' Institution here. We are happy to learn, that the number of members in this Institution has increased to upwards of forty, that the middle and higher classes of the town begin to take an interest in it, and that a public meeting is contemplated, in the week after next, to establish it in due form.

KENDAL.—In April 1824, it was resolved to form a "Mechanics and Apprentices' Library and Institute;" of which any person paying to the amount of three guineas in money or books, or 4s. yearly, might become a member, and be eligible, as well as vote, for the committee of management. There are 150 subscribing members, all of the working classes, beside 50 or 60 by payment for life. The library already amounts to

300 or 400 volumes; and it is stated by the worthy President, Mr. S. Marshall, that "the books are nearly all out at a time, such is the ardour for information." Original papers upon subjects of science and literature are read at the quarterly meetings; no topics being excluded from discussion except those of a polemical and party nature. A course of lectures was delivered upon the philosophy of Natural History last autumn, and one on Mechanics will be given this season; probably one on Chemistry also. "Great delight is stated to have been expressed by the students who attended the lectures."

KILMARNOCK.—The Institution here was formed in November 1823, having in view to promote the theoretical and practical knowledge of philosophy. Each member pays on admittance, 10s., and 5s. yearly. The Society consists at present of 120 members, with a library of upwards of 200 volumes.

The funds realised since the institution of the Society, amounts to	£84	0	0
Expended since its institution,	50	14	9
	£33	5	3
Sum due to the Society at 30th March last, ...	29	0	0
Funds in the hands of the Treasurer, ...	£62	5	3

In the absence of a public lecturer, some one of the members reads an essay on Natural Philosophy at the Society's monthly meetings.

At the annual general meeting in March last, the following gentlemen were chosen office-bearers, *viz.*—Mr. John Colvil, President; Mr. Wm. Finnie, Vice-President; Mr. Wm. Thomson, Treasurer; Mr. D. R. Andrews, Secretary; Mr. James Sym, Mr. George Paxton, Rev. George Lawson, Mr. Thomas Morton, and Mr. Robt. Roger, Directors.

LANARK.—A Mechanics' Institution has been likewise instituted here. The first meeting took place on the 19th of February last, and was but thinly attended, although it has since increased. The members meet every Saturday evening, betwixt the hours of eight and ten. They have already purchased about 30 volumes, chiefly history.

The honorary patron is Robert Hutchison, Esq. Provost of Lanark. The management of the Institution is invested in a committee chosen quarterly from, and by, the body of the members.

The following report of the committee of management will show the principles of the Institution, and what are the present views of its supporters.

Report of the Committee of Management of the Lanark Mechanics' Institution, regarding their Articles.

Your Committee, before submitting to the notice of their constituents the Regulations which they have drawn up, beg leave to call your attention to the nature of these Regulations, and to the views which your Committee entertain regarding the success of the Institution, hoping that by the following remarks any inconsistency that may appear in these Regulations will be fully explained.

Owing to the limited number of mechanics in Lanark, whose inclinations led them to the same pursuit which we are at present engaging in, and also to the disadvantages we labour under with regard to procuring, in this place, scientific individuals who could lecture, it was found necessary that this Institution should be commenced upon a limited scale; and, accordingly, you resolved that it should be conducted on the principles of the Glasgow Gas Workmen's Institution, and that application should be made for a set of their Regulations; these your Committee have received. However, upon considering the circumstances of Institutions of a similar nature, in other places, your Committee find that there are several flourishing Institutions which were commenced under as untoward circumstances as your own.—Taking confidence from the success of these Institutions, and in the anticipation of obtaining that support which they have received, your Committee have drawn up a set of Regulations upon the basis of the Glasgow Mechanics' Institution, but at the same time so blended with the Glasgow Gas Workmen's as to suit this Institution, whether it continue in its present limited scale, or be conducted upon the most extensive principles.

Lanark, 13th April, 1825.

LEEDS.—Through the influence and exertions of Messrs. Gott and Marshall, a Mechanics' Institution was established in this city, which was opened in January last. Any person recommended by two members is admitted upon paying two pounds, and

10s. yearly; and any person for 5s. half-yearly, is entitled to all its privileges, except that of taking part in the management. Two pounds seems too high for the admission of the workmen as generally as is desirable: a considerable number of them are no doubt members; and as such, both vote and are eligible as directors, but the great majority of voters belong to the higher class. A slight change would remove this difficulty. There are 146 members and 136 subscribers already; books of the value of £500 are purchased. The Institution is a very promising one, and the number of ingenious and public-spirited men in that neighbourhood ensures its success, provided no impediment be thrown in the way of a cordial co-operation on the part of the men. The most exemplary spirit of union among men of very different parties in religion and politics has been exhibited; and the liberality of the masters is sure to be duly appreciated by those in their service.

On Thursday evening, Dr. Williamson delivered a lecture in the Philosophical Society's Hall, before the Mechanics' Institute, " On the method of obtaining knowledge by induction, and its connection with the modern improvements of science." The first part of the lecture was occupied by an attempt to show the causes which had impeded the progress of natural science amongst the ancients, who, notwithstanding the mighty powers of genius by which many of them were distinguished, made very few discoveries in the material world. The introduction of superior methods of inquiry by our great countryman, Bacon, was considered, and the influence his views had exerted in every department of science. At the close of the lecture, Dr. W. took a rapid survey of the different condition of the great body of the people at different times, in reference to knowledge; and observed, that the establishment of Institutions of this nature, marked a new and peculiar era in the history of mankind. He concluded by some remarks on their leading objects and their beneficial tendencies.

A course of lectures have been delivered on the steam engine by Mr. Lockwood, which were concluded in February last.

LIVERPOOL.—In this city there was some time ago instituted a Mechanics and Apprentices' Library, from which the most beneficial effects are said to have resulted.

A public meeting was held in January 1824, for the purpose of establishing it as a Public Institution. It had previously been very successfully commenced through the private exertions of Mr. Egerton Smith, and some other benevolent individuals. The Lord Mayor being in the chair, several resolutions were passed, among which were the following:—

That the numerous schools in Liverpool having created, amongst the labouring classes of the community, a commendable taste for useful reading, it is desirable to furnish mechanics and apprentices with the means of gratifying that taste, by offering them the use of a well-selected library, subject to such conditions and regulations as shall hereafter be determined upon.

That the support and increase of this library shall be effected by means of benefactions and annual subscriptions, and by donations of books, and by such other means as may be deemed expedient; particular regard being paid, by a committee to be appointed, to the exclusion of such works as contain polemical divinity, or party politics.

That benefactors of not less than £2 2s., subscribers of not less than 4s. per annum, and donors of books, amounting in value to £2 2s., (to be estimated by the committee,) shall be members of this Institution.

That those mechanics and apprentices who are not members of this Institution, but who are desirous of partaking of its benefits, shall, for the present, be furnished with books, on being nominated thereto by such members, and subject to the rules of the Institution.

That a committee, now to be appointed, be empowered to draw up a code of laws for the government of the Institution, subject to the approbation of a general meeting of the members, on an early day.

By the annual report for 1824, it appears to have flourished remarkably. Twelve months ago, the number of readers was 400, and the library contained 800 volumes: now, the readers amount to 800, and the volumes to 1800. The sum paid as the regulations are at present, is two guineas in money or books, for life, or 10s. 6d. a year; and every person paying either way, has the privilege of recommending readers, who receive books on the guarantee of any member. The committee of direction is chosen by the whole members, and all are eligible. The method of keeping the different books of receipt, loan, register, guarantee, and catalogue, is admirably contrived for the quick and accurate dispatch of business; and is found so successful in practice, that 700 or 800 books are easily exchanged weekly in a very short time; 250 or 300 volumes being received from, and as many given out to, 200 readers in little more than an hour without any confusion. Where there is so much to commend, it is disagreeable to hint at any imperfection; but certainly a course of lectures might without difficulty be added to this prosperous establishment; and although any mechanic may, for half a guinea, enjoy all the privileges of a member as the society is now constituted, it is plain that the bulk of the members do not belong to this class, although on the guarantee and recommendation of members, by permission of the committee, they partake of its benefits. If all were admitted to the library and management on somewhat lower terms, or to the library and lectures upon those terms a little raised, and none allowed to partake of either for nothing, there can be no doubt that a greater interest would be excited among them, and the Institution be more firmly established and more certain of extending its numbers.

From the several letters, however, which we have seen, and the discussion which has taken place in the different Liverpool Newspapers, and in particular in the Kaleidescope, there is every reason to think that lectures will very speedily be added to the library, and that Liverpool will possess a Mechanics' Institution inferior to none in the kingdom.

Liverpool likewise possesses an Institution which we greatly admire, although we suspect it is not very general—"A Female Apprentices' Library." We shall give the particulars of it in a future Number.

LONDON.—The complete success of Dr. Birkbeck's plan both at Glasgow originally, and afterwards in a place abounding far less with artizans, very naturally suggested the idea of giving its principles a more general diffusion by the only means which seem in this country calculated for universally recommending any scheme—its adoption in London. An address was published by Messrs. Robertson & Hodgkin, in the Mechanics' Magazine, October, 1823; and the call was answered promptly by Dr. Birkbeck himself, and other friends of education, as well as by the master mechanics and workmen of the metropolis.—A meeting was held in November; the Mechanics' Institution was formed; a subscription opened; and a set of regulations adopted. One of these, by far the most important, and one which should be considered altogether essential, provides that the committee of management shall be chosen by the whole students, and consist of at least two-thirds working men. The plan was so speedily carried into execution, that in January, Dr. Birkbeck, the president, most appropriately opened the Institution with an introductory address to many hundred workmen, crowding from great distances in the worst season, and after the toils of the day were over, to slake that thirst of knowledge which forms the most glorious characteristic of the age; nor was the voluntary offer of a course of lectures upon Mechanics less appropriate on the part of Professor Millington, who, with an honest pride, declared to his audience, that he had originally belonged to the same class with themselves. In the course of the year, lectures were delivered by Mr. Phillips on Chemistry, Mr. Dotchin on Geometry, Dr. Birkbeck on Hydrostatics, Mr. Cooper on the application of Chemistry to the Arts, Mr. Newton on Astronomy, Mr. Tatum on Electricity, and Mr. Black on the French Language, to great and increasing numbers of workmen. About a thousand now belong to the Institution, and pay 20s. a year. Temporary accommodation has hitherto been provided at the chapel in Monkwell-Street, formerly Dr. Lindsey's; and if upon such a subject we might make any account of omens, surely a scheme for the improvement of mankind could not be commenced under happier auspices than in the place which so virtuous and enlightened a friend of his country had once filled with the spirit of genuine philanthropy and universal toleration. But extensive premises have been procured in Southampton Buildings, for the permanent seat of the Institution; and the foundation has been laid there of a spacious lecture-room, and other suitable apartments for the library and apparatus. The sum required for these buildings exceeds three thousand pounds; and it has been generously advanced by Dr. Birkbeck. Others have made presents of money, books, and apparatus; and we should mention with greater admiration, the gift of a thousand pounds from Sir Francis Burdett, but that those who know him and who mark his conduct, have so long since become accustomed to such acts of wise and splendid benevolence, that they cease to make us wonder.

An Elementary School of Arithmetic was opened on the evening of the first anniversary, and has since been regularly continued on Tuesday, Thursday, and Saturday evenings in each week, with the exception of an interval of a few days at Christmas. The attendance of the members in the Arithmetical School has been numerous and regular, and the mode of instruction adopted by Mr. Collins has afforded general satisfaction.

Arrangements have been made for commencing a Mathematical School for the instruction of the members in Algebra, Geometry, and Trigonometry, which will be opened in a few weeks, and will be followed by the School of Perspective and Architecture, as soon as circumstances will permit.

Dr. Allen has delivered lectures on the new method of investigating the Powers of the Human Mind; Mr. Partington on Optics; Dr. Birkbeck on Acoustics, and also on the Phenomena of Winds; Mr. Ogg on Geology; and Mr. Wheeler has commenced a course of lectures on Botany.

MANCHESTER.—This great and wealthy and industrious town might well be expected to be among the earliest and most zealous in forming an Institution. This was resolved upon in April, 1824, and ample preparations appear to have been made for carrying the plan into execution—£798 had been received before the end of July; of that sum, £243 were annual donations; and 191 mechanics had entered their names as subscribers, at one pound a year. A library is forming, and preparations making for delivering a course of lectures. The management of the Institution, however, is entrusted to Directors chosen by and among the honorary members only, and these are persons who either pay ten guineas at entrance, or a guinea a year, beside the subscription of 20s.

The Mechanics' Library was opened to the subscribers to the Institute on Monday, 26th Feb. and a large number of persons have already come forward, since that time, and paid subscriptions to entitle them to take out books for perusal. The library, at present, consists of about six hundred volumes.

MUSSELBURGH.—In the honest town of Musselburgh, a Mechanics' Institution has within these few weeks been established. A few mechanics first met for the purpose of considering the practicability of establishing such an Institution; some were very sanguine of its success, whilst others doubted of it altogether: but mustering resolution, they advertised a public meeting to be held on the 22d of April. The Magistrates at once granted the use of the Town Hall for the meeting, and it was highly delightful to perceive, that the Hall was crowded to excess. Bailie Kemp was called to the chair; and a short address was made to the meeting by Dr. Moir, on the advantages of knowledge, and on the utility of Institutions such as that which they had met to establish. The Chairman then proposed several resolutions, which were seconded by Captain Stewart, R. N., Millhill. In a short time, 53 persons entered their names as members; and Ten Guineas were subscribed and presented as a donation by the gentlemen present. The annual payment is fixed at five shillings.

NEWCASTLE.—The proceedings in London gave a great and general impulse to the friends of education in the country, and the town of Newcastle-upon-Tyne was the first to profit by it. An Institution for the instruction of mechanics by books, lectures, and scientific meetings, was established in March 1824, and the first meeting was held under the auspices of Mr. Turner, who opened it with an excellent address on the 11th of May. The members are admitted by ballot; but any person paying 12s. a year is eligible; and the committee of management consists of the workmen as well as their masters. The library consists already of 600 or 700 volumes. Beside benefactors, there are 240 subscribing members, and the meetings for discussion are held monthly; at these, papers are read and conversations entertained upon any scientific or literary subject, with two exceptions only—*controversial* divinity and *party* politics. A fund is forming for the purchase of apparatus, and lectures will soon be commenced. Mr. Turner, indeed, several years before the establishment of the society, had lectured upon Natural Philosophy to the working classes. The Literary Society which has long flourished at Newcastle, supported by the rich, must have contributed greatly to the love of knowledge which is now diffusing its blessings among the other classes; and the excellent principle which it adopted of vesting no property or privileges in those who paid a sum by way of admission money, but extending an equal share in its management and advantages to yearly subscribers, has been strictly acted upon by the founders of the new Institution.

At the last meeting of the Mechanics' Institution at Newcastle, which was very numerously attended, a valuable paper on Historical Architecture, by Mr. Dobson, was read by one of the Secretaries, which excited great approbation. The thanks of the meeting were voted to Mr. D., and a hope expressed that he would make it the first of a series of papers on similar subjects.

NORWICH.—At this place a meeting was held a few months ago, and attended by the most respectable inhabitants of all sects and parties, in order to found a Mechanics' Institution. The zeal and information displayed there, leave no doubt whatever of the plan succeeding. Dr. Yelloly stated to the meeting, that the rules of the London Institution had been communicated by Dr. Birkbeck.

NOTTINGHAM.—A society, for the discussion of literary and scientific subjects, has recently been established in the town of Nottingham. The Rev. R. W. Almond, M. A. is the President of the new Institution, and a highly respectable committee have undertaken the management for the ensuing year.

PORTSMOUTH.—Means are being adopted for erecting a Mechanics' Institution in this place, and a communication has been received from them by the Committee of the London Mechanics' Institution announcing this intention.

PRESTONHOLM, LANARKSHIRE.—An Institution on the plan of that at the Glasgow Gas Work, has been formed by the workmen at the Flax Mills of Mr. John Craig, at that place. Mr. Craig deserves the greatest credit for the encouragement which he has afforded to his men.

RENTON, DUMBARTONSHIRE.—In this village, a Literary Society has existed for rather more than a year, at which questions of any kind are proposed and debated by the members.

RICHMOND.—An Institution has been formed at this place, in the North-Riding of Yorkshire, under the patronage of Lord Dundas, and John Hutton, Esq. of Marske, the High-Sheriff of the County. A meeting of the inhabitants friendly to the design, was held on the 28th Feb. last, at which a series of resolutions were passed, forming the outline of the Institution. It is determined in the first instance to confine the project to a library and reading-room, the annual subscription to which is fixed at eight shillings, and the officers are to be chosen by and from the subscribers at large, without distinction. (See No. LXVI. p. 128, Vol. III. of our Magazine.)

ROSS, HEREFORDSHIRE.—A communication has been received by the Committee of the London Mechanics' Institution, announcing the intention of forming an Institution of the same kind here.

ROTHERHAM.—A meeting of the mechanics of this place and its neighbourhood, was held on Monday the 28th February last, for the purpose of establishing a Mechanics' Institution. Resolutions were passed for the purpose of founding a library and obtaining such models and apparatus as the funds of the society will permit.

SHEFFIELD.—A Mechanics and Apprentices' Library was instituted in this city, in December 1823, and opened in the February following, under the able and zealous superintendence of Mr. Montgomery, a name well known in the literary world, and held in deserved honour by philanthropists. The rules appear to us most excellent. In the workmen is vested the property, in shares of 5s. each, paid at first, and they afterwards pay 6s. a year; they form the class of *proprietors*; the others, the *honorary* members, present gifts in money and books, and may, if chosen by the body at large, fill the offices, but have no share in the property. The committee may consist entirely of proprietors; and must have two-thirds from that body. Apprentices have the use of the books for 4s. yearly. The librarian is to attend daily, and have the care of the property; he is therefore paid: perhaps this might be rendered unnecessary, by adopting some of the judicious regulations established at Liverpool, and exchanging the books once a week. Every donor of a book must write his name in it, as a kind of check; and a rule has been made, as we understand, after a very thorough and somewhat earnest discussion, giving an appeal against the admission of books to the ministers of the different denominations who are subscribers; this rule has, however, never yet been acted upon. Members lose the benefits of the society, if in the workhouse or in prison; but are restored when liberated without payment of their arrears. Of this admirable Institution there are now 360 members; of whom 310 are proprietors, and the numbers of these increase daily. There are 1400 volumes, including some most liberal donations; all collected in nine months; and 30 apprentices receive the benefits of the society on the terms already stated. A Library and Philosophical Society has long flourished at Sheffield, and it now reckons 350 members, almost all manufacturers and tradesmen. Lectures are occasionally given in it, and we rejoice to hear, that there is an arrangement in agitation for admitting the workmen to the benefit of these as soon as the new premises are ready. It is related, as an interesting anecdote for the encouragement of this design: "We have in our employment a common cutler, who found leisure, in a bad time of trade, to amuse himself with entymology, and who has made great progress in arranging a collection of insects for our museum. Another youth, in an obscure station, is preparing specimens of our Flora for the same. Ingenious mechanical models have been repeatedly brought before us by persons from whom little beyond ordinary handicraft could have been expected."

SPITALFIELDS—A Mechanics' Institution is about to be formed in this place under the auspices of Dr. Birkbeck.

Several enlightened individuals, taking into consideration the distance of this part of the town from the central Institution in Southampton Buildings, and also the dense population by which it is inhabited, comprehending at least 20,000 workmen, conceived the idea of communicating scientific instruction to them, by the establishment of one of those admirable Institutions, which seem destined to effect a complete revolution in the sentiments and habits of the operative mechanics of this country.

With a view of ascertaining the probability of success in this laudable undertaking, diligent inquiries have been made among the masters and journeymen in the silk trade, and the result of these inquiries was so satisfactory, that the gentlemen who had so kindly interested themselves in the business, felt no hesitation in determining to attempt the accomplishment of their design. As a preliminary step, it was, however, considered advisable, that a few lectures should be delivered to the mechanics of Spittalfields, previous to the final arrangements for establishing the Institution, in order that they might be better acquainted with the principles upon which it was to be conducted, and the advantages to be derived from its establishment.

For this purpose, a request was made to Mr. Partington, of the London Institution, that he would have the kindness to deliver the introductory lectures, with which request he immediately complied; and the enlightened and philanthropic President of the London Mechanics' Institution, Dr. Birkbeck, having also consented, at the solicitation of the promoters of the plan, to elucidate its nature and objects by an opening address, it was finally determined that the preliminary address of the worthy Doctor, and Mr. Partington's first lecture, should be delivered on Thursday, 10th March, at Gibraltar Chapel, in Church-Street, Spitalfields.

The chapel, which will contain about 800 persons, and the use of which had been kindly granted by the Rev. Mr. Brown, was crowded to excess at an early hour, and the entrance of Dr. Birkbeck, accompanied by the gentlemen who have so indefatigably exerted themselves on this occasion, was greeted with loud applause. As soon as silence was obtained, the learned Doctor commenced his introductory address, at the conclusion of which, Mr. Partington delivered his lecture. Both address and lecture were received with the greatest applause; so that there is little reason to doubt of the success of the undertaking.

WIGAN, LANCASHIRE.—An Institution has been formed here on the plan of that which has been found so useful at the Glasgow Gas Work, with this difference, however, that instead of being applicable only to a particular work, it is open to the mechanics of the town and neighbourhood.

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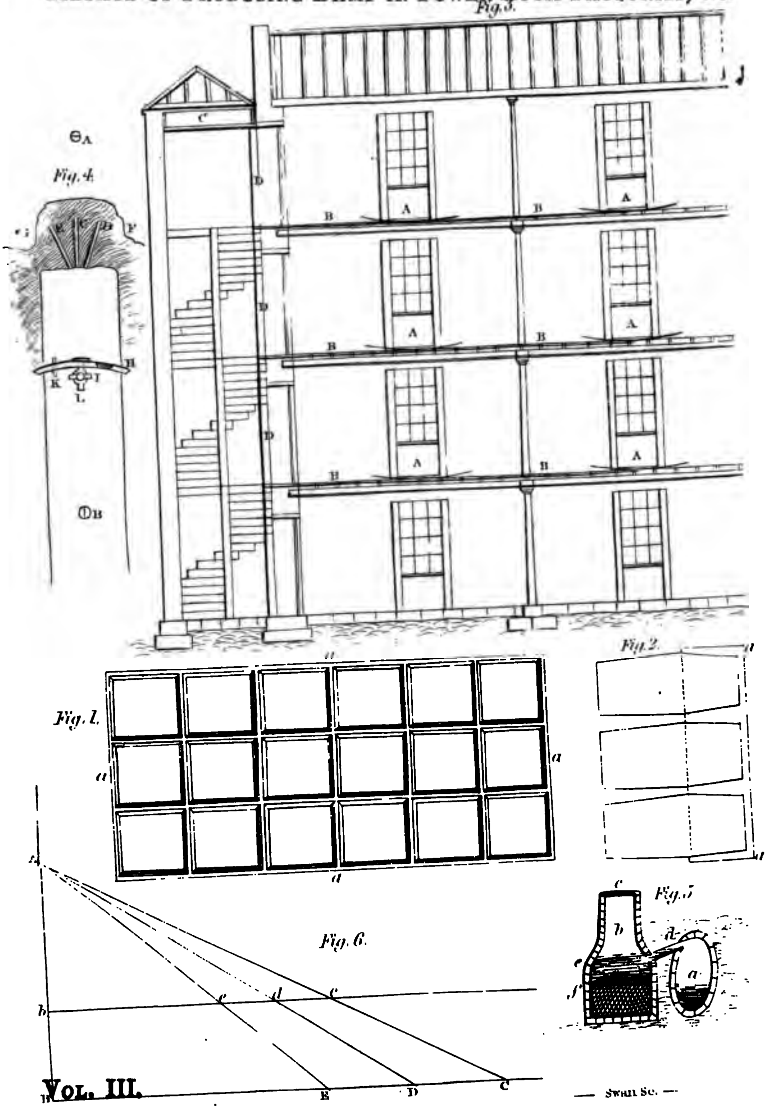
CONDUCTED BY

A Committee of Civil Engineers and Practical Mechanics.

> " Man in inquisitiveness should be strong,
> From curiosity doth wisdom flow:
> For 'tis a maxim I've adopted long,
> The more a man *inquires* the more he'll *know*."

No. LXXIII. *Saturday*, 14*th May*, 1825. Price 3*d.*

METHOD OF PRODUCING DAMP IN POWER LOOM FACTORIES, &c.



IMPROVED METHOD OF PAVING STREETS.

By J. Finlayson, Farmer, Muirkirk, Ayrshire.

To the Editor of the
London Journal of Arts, &c.

Sir,—The subject of roads and road-making having of late occupied a considerable portion of public attention, perhaps you will permit me, through the medium of your useful Journal, to suggest a novel method of laying down a road-way, suited to the streets of London and other great towns. The principle material of which I propose to make my road is wood; but let not the idea be hastily discarded, because so perishable a material is to be employed, until my views in so doing, and plan of applying it, are fully understood. Many years back I laid down a piece of road of the kind I am about to describe, which has ever since been in use, and remains in good order. I very recently took up a portion of the road, for the sake of observing it, when the wood of which it was constructed appeared to be as sound, and likely to endure, as on the day when the road was first laid down. My engagements having been in the agricultural line, and in the northern part of this island, I have not had that opportunity of exhibiting my plans in operation in the metropolis, which I now intend to do at an early period.

The method of making roads adopted by Mr. M'Adam, is unquestionably excellent in its way, and well calculated for open situations; but in the narrow streets of London, and other large towns, where the traffic is incessant, and all descriptions of carriages are constantly rolling over the road in nearly the same tracts, the wear and tear is excessive, and far beyond any thing generally contemplated; consequently, the mud in winter, and dust in summer, will be a nuisance too great to be long endured by the inhabitants.

Conceiving, then, that the public will very soon be convinced that nothing but a stable material will answer for the road-ways in the metropolis, I shall dismiss the consideration of M'Adam's plan, and, without further preface, describe the mode by which I propose to remedy existing evils, and to form a road that shall be stable, durable, clean, and prevent that astounding noise which is so extremely annoying, not only to strangers, but to the inhabitants themselves.

In fig. 1, a plan or horizontal view is given of a portion of paving for a public street of the kind which I am suggesting. Fig. 2, is a vertical section of the same, taken crossways; *a, a, a, a,* is an oblong box made of cast iron with cross partitions, leaving eighteen square sockets, into each of which a wooden block, the grain upwards, is to be inserted for the purpose of occupying the place of the ordinary paving stones. These blocks may be of any kind of wood that would answer for that purpose, though I should prefer larch fir, as that is less likely to decay than most other woods, and is more tough and difficult to be split or torn asunder, and when kept damp, as it naturally would be while in the earth, would last for ages. The dimensions of these wooden blocks might be about eight inches square on their top surface, and about eighteen inches high; their form, as seen in the section, fig. 2, should be slightly tapering from a little below the middle downwards, for the purpose of fitting solidly into the recesses of the iron box, and also slightly tapering upwards from the same part, as shown in the section, for the purpose of allowing gravel or broken stones to be introduced between the wooden blocks when fixed, in order to wedge and confine the blocks firmly, and prevent them from being shaken or displaced by the carriages as they pass over.

The iron boxes may be about four feet and a half by two feet and a half on their superfices, and about eight inches deep, or any other dimension that circumstances may render convenient. The bed or foundation of the road being prepared by rolling, ramming, or otherwise, so as to be perfectly solid, and as level as possible; as many of these boxes are to be laid down as will cover the road, and which are to be made as secure as may be, on the sides, to prevent them from being pushed from their situations, into the recesses of the iron boxes; the blocks of wood previously prepared, and all of one length, are to be introduced, the length-ways of the grain, in a perpendicular direction. When they are thus placed, their surfaces being all level, gravel, broken stones, or hard rubbish are to be rammed in between the wooden blocks, and the road will be formed ready for immediate use, in such a firm manner, that neither time, nor the heaviest weights which may pass over it, will in any degree alter its level, or destroy the materials of which it is composed.

The advantages of this plan for paving the streets, are:

1st. That being laid on an iron floor, and the blocks forming right angles on all sides, the whole would be so completely packed, that there could be no possibility of its being shifted or deranged, as the common carriage-way is subject to, and which makes it so very imperfect.

2d. Should any portions of it require to be raised at any time to get to the water or gas pipes, a thing which daily occurs, it could be laid down again precisely in the same manner as it was taken up; whereas in breaking the common road-ways on the M'Adamize plan, the materials cannot again be laid so as to connect or assimilate with the rest, from which it has been broken.

3d. It is evident that there would be much less waste on wood set on end, as above described, than on the hardest whin or granite, if exposed to the same wear. I made the experiment many years ago in a pavement upon my father's premises. Our stones frequently sunk, and for experiment, I cut some pieces of wood according to the size required, and introduced them in place of the stone, set on end in the same manner I have already described, with wood planks at the bottom, and after a lapse of twenty-five years, I observed that the granite has undergone more wear than the wood, the latter of which now stands more prominent and flush than any other part of the causeway that surrounds it. I raised some of the wooden blocks, expecting them to have undergone considerable decay, but was surprised on finding that the wood was quite as fresh as on the day it was laid.

4th. As there is less waste on the wood than on the granite, there will of course be less mud or dirt in wet weather, and less dust in dry.

5th. The wood being laid on a complete level between the footways, there would not only be much more accommodation for all carriages, but the streets would also be rendered capable of being washed in the most complete manner, by discharging from the fire plugs as often as necessary a quantity of water, which from the level of the paving would be enabled to flow over its surface, and carry with it all the mud in wet weather, and would lay the dust in dry.

6th. The noise of the passing carriages would be entirely deadened. There would be little vibration and jolting of carriages. They would run along such a wooden street with the same comfort to the riders as they would on the Mall in St. James's Park.

7th. The gas and water mains should be laid in a trough of cast iron, of sufficient size to hold them, extending along each side of the pavement, and might be covered with a cast iron top or lid, upon which the blocks or pavement would be laid; and when the gas or water pipes at any time required to be repaired, access could be had to them at one-fourth of the present trouble and expense.

8th. There would be at least thirty per cent. saved in the wear and tear of horses and carriages.

9th. In proportion as the wooden pavement was introduced, the roads in the vicinity of London would be improved, by the same granite stones, when broken, being applicable to the making or mending of those roads, in preference to the use of the flints.

10th. In the same proportion as the street would be cleared of filth, mud, and vegetable matter undergoing decomposition, (by which the air is so much contaminated,) so would the health and longevity of your citizens and inhabitants be preserved and extended.

I am, Sir,
Yours, &c.
John Finlayson.

METHOD OF PRODUCING DAMP IN POWER-LOOM FACTORIES.

Gentlemen,—From the many improvements which have been made, and essays written, on power-loom weaving, it would appear it has now become an object of extensive speculation; but it still labours under a very great disadvantage, (if the factories are built high,) *viz.* the want of a sufficient portion of damp. As I have never as yet heard or seen any hints with regard to remedying this, I beg to submit my plan for your examination, which, if found to deserve a place in your valuable Magazine, you will much oblige me by inserting.

It is well known that cotton-yarn has a very great affinity for moisture, so much so, indeed, as to increase very materially in weight by being hung over vessels filled with water. It is likewise known that the atmosphere becomes so loaded with humidity from the presence of water, as to affect the hygrometer very considerably. On these properties this method of moderating the drought in power-loom factories depends. It is to place vessels filled with water under the looms, of a sufficient length and width, and about one inch deep, so formed that the damping surface may be increased or diminished at pleasure, by supplying or taking away the water. The atmosphere may thus be always kept at a degree of humidity, according as the work requires it, by referring to a hygrometer, placed there for the purpose; and, consequently, the yarn will be prevented from becoming brittle and breaking, as it invariably does when there is too great a portion of drought. Should the moisture seem to come too direct on the yarn, let the vessels be placed in any other part of the house, probably over the looms, so that the atmosphere be first affected.

The vessels in each flat ought to be all on one level, and connected together, so that they may be filled or emptied at once, and in any proportion, from a pipe on the outside, by the overseer, independent of the workers within. The water for this purpose being pumped up by the engine, may be changed every two or three days, so as to prevent any smell arising from stagnation.

Fig. 3 represents a section of this plan, wherein A A are the vessels to be placed under the looms, and connected by means of the pipes B, B, to another, D, D, in the passage, which is supplied from the cistern C, and furnished with proper stop-cocks, &c. and a graduated glass tube for the purpose of raising or lowering the water in the vessels when required.

I am, yours, &c.

J. A.

South Hanover-Street, 5th May, 1825.

ON DRAINING OLD WASTES IN COAL MINES.

Gentlemen,—I beg leave to hand you the following, as an answer to a query proposed by a "Coal Hewer" in No. LXVIII. of the present volume of your Magazine. The plan that I propose, I have seen acted upon with great effect in a case, as far as I can judge, nearly similar to that mentioned by your Correspondent. The pit, A, (fig. 4,) in which the workings were to the dip, got so deluged with water, that the men were obliged to abandon it: another pit, B, was sunk at some distance from the old one, the workings of which were to the rise, so that the men were always in danger of breaking in upon the old workings of the pit A. The plan pursued to obviate the danger was this: they kept three bores always before them, of about one, or one and a half inch diameter each; one in the centre as at C, of 30 feet long, the other two, E and D, went off at angles of 45 degrees, they were 24 feet long. The use of the latter being in case any of the old workings might extend farther at the sides than the centre C, as shown at G and F, so that they were always sure to give timely warning of the approach to the old waste. These bores or tunnels can be so enlarged or diminished as to discharge only as much water as the engine is capable of delivering. But there is a plan I have seen followed in pits where the workings were both to the rise and dip, and when the water was coming in such quantities as to deluge the low workings, as in the above case; a dam was made of timber across the mine as at H, the seams of which were caulked with oakum, the ends of the logs were sunk in the sides of the mine from three to four feet horizontally, the lower one being sunk in the pavement, a pipe was put through, having a flaunch on one end to fix it inside, and a stop-cock at the other to regulate the quantity of water as shown at L; at the top of the dam was an air-tube, K, to take away any risk of the dam bursting. The sluice door at I is for the convenience of the workmen caulking the seams inside of the dam; it opens off the inside, and the pressure of the water keeps it tight. This plan is of great service in insuring the safety and ease of the men while working, and as it will in some degree answer the purpose of your Correspondent, I shall feel obliged at your inserting it.

I am, yours, &c.

Glasgow, 28th April, 1825. S. S.

P. S. Since writing the above, I see that your able Correspondent, G. M. has had the start of me; but I think from a careful perusal of his letter, that he has indeed conceived a "wrong idea" of the subject, and gone on the premises, that the workings were on a horizontal plane, which is never the case in any coal pit in Scotland that I have seen, and that is not a few; they always rise or dip to a certain angle, sometimes as high as 45 degrees; however, such discussions are highly useful, as they tend to elicit facts, the establishment of which ought to be the chief boast of your useful Magazine.

ON WATER TRAPS FOR COMMON SEWERS.

GENTLEMEN,—It has often occurred to me when passing through the streets in London, on seeing men going down into the common sewers to cleanse them, that some improvement might be made to save the men the very disagreeable, and, I may say, dangerous mode at present pursued. Being a subscriber to your valuable little work, I have again had my thoughts roused to this subject, by seeing some of your Correspondents' ideas made public, for "Water traps to prevent smell from common sewers." Now I think my idea to remedy what I have above complained of—and my idea to simplify your water trap—may, with the greatest ease, be brought together: the accompanying sketch may serve to explain my thoughts:—

a, (fig. 5,) is the common sewer; *b*, a pit (made to what depth, and what shape you think best,) along side the sewer; *c*, the grating from the street; *d*, a trunk to communicate with the sewer and the pit, but elevated at the entrance into the sewer, that the other end may dip into the water to serve as a water or stink trap; *e*, the water; *f*, the dirt and other rubbish that will not float away. Now, the intention of the pit is, to save the men going down into the sewer, as the grating may be thrown back every three, six, nine, or twelve months, to take out the dirt from the bottom, and the trunk is my idea to serve as a trap (to prevent all unpleasant smell) on a simple plan. Should the above be thought worthy of a place in your Magazine, that by its simplicity it may be found worth a trial, and by that trial it may be found to answer the purposes it is intended to remedy, I shall feel happy in having added a comfort to the good city of Glasgow.

I am, yours, &c.

W. O.

London, 8th April, 1825.

ANSWER TO THE QUERY AS TO THE ALTITUDE OF A TERRESTRIAL OBJECT.

GENTLEMEN,—I observe in your instructive and useful Magazine a query from X. Q *viz.* "The altitude of a terrestrial object situated above the horizontal plane, being 30° 45′, 37° 43′, and 60° 12′; it is required to determine from thence the perpendicular height, with or without a demonstration."

I fear that your Correspondent has left out one link in the data that cannot be dispensed with, namely, the length of a side of one of the triangles which his other data supplies, since the angular altitudes of the object A *b*, fig. 6, as seen from *c*, *d*, *e*; and of A B, as seen from C, D, E, will be the same respectively.

Your Correspondent is probably aware that if C, D, B, be in the same straight line and parallel to the horizontal level, the question is answered by the application of a problem in plane trigonometry, provided the distance between C and D is measured; and in that case the measure of the altitude from E becomes unnecessary. For, in the triangle A, B, D, since the angle at B is a right angle, and since the angle at D is measured, the angle at A is known, but the exterior angle A, D, C, = angle B, A, D, + A, B, D, ∴ in the triangle A, D, C, the angle at D is known, and since the angle at C is measured, ∴ the angle at A is known, and the side D C is measured. Now, the sides A D and A C may be found, since they and the known side D C are as the sines of their opposite angles respectively. Let the side A D be found; then as radius : A D : : Sine angle A, D, B : side A B, namely, the height of the object.

I am, yours, &c.

A Sailor.

ON DRAINING OLD WASTES IN COAL MINES.

Gentlemen,—G. M.'s answer to the query by a "Coal Hewer," in No. LXX. of the present volume of your Magazine, is imperfect. If the boundary of the waste is ascertained exactly, there will be no difficulty or danger in driving the new workings within four yards of the waste, and after this is done, a bore of an inch and half in diameter should be put through upon it, near the bottom of the coal, so that it may carry off the most of the water. If, again, more water issues from this bore than the engine can discharge, a plug should be put in it, having a cock, so that the quantity of water may be regulated thereby; but if, on the other hand, the engine can discharge more, a second bore may be put through, as it would be difficult to enlarge the first, on account of the run of water. G. M. proposes to make the bore or mine communicate with the waste above the surface of the water, which would be very difficult, and, in most instances, (with a bore,) impossible; because, if the waste is filled with water from the pavement to the roof, as it most likely will be, no communication could be made from the same seam of coal with a bore, to communicate with the waste above the surface of the water contained in it, as it is intended to communicate with the waste to the dip of the old field. That this is evident will appear to him.

If there is no plan extant of the old waste, and it cannot be exactly ascertained, a bore should be kept going at least four yards a-head of the workman who is driving for it.

I am, yours, &c.

A. K. J.

Kilwinning Colliery, 4th May, 1825.

ON THE CRANK.

Gentlemen,—In No. LXIX. of the present volume, I observe a *letter by A. B. on the crank*, and one on the water-wheel. In the former of these, A. B. begins by complimenting W. C. on lendi his aid to the discovery of truth; but immediately it is insinuated that W. C.'s communication is defective, because he has not shown the fallacy, that is to say, the singular process in A. B.'s brain, which gave birth to his supposed improvement. This is surely requiring too much, as the comparing a crank to an inclined plane probably never entered the head of any other person. He who arrives at true principles in mechanics, renders an essential service to mankind, nor is his merit lessened because he does not undertake the foolish task of accounting for others' blunders. Again, W. C. is tacitly charged with want of accuracy in saying that no power is lost by the crank: for though, says A. B., the loss is not so great as $\frac{1}{3}$ it is $\frac{1}{90}$; but as A. B. did not add this $\frac{1}{90}$ part to the $\frac{1}{3}$ in his first letter on the crank, he is either chargeable with the inaccuracy thrown on W. C. or he has found out this $\frac{1}{90}$ of loss since he wrote it. The latter supposition is most probable, as it has nothing to do with the other loss, but is derived from a source totally different, but equally unfounded. A. B. might as well tell us that it is not so far from Glasgow to Dollar as from Dollar to Glasgow, as that the diameter of the sweep of the crank is not equal to the stroke of the piston, if both ends of the beam are equal, or that any power is lost though they should be unequal. This is so well known to all who understand the simple lever, that to prove it would be a waste of words. I would just refer to the weighing beam or balance, which is the same as the beam of an engine in every point that affects the question concerning this loss of a $\frac{1}{90}$ part of the power; the one end rises as the other falls, and both describe arcs of a circle: put a pound into one scale, does not every child know that it is exactly balanced by a pound in the other, and not a grain of weight or power is, or can possibly be lost?

As to A. B.'s other letter on the water-wheel, I have to observe, that I refuted the principle of his supposed improvements in No. LXVII. (more than two weeks ago,) so that had he not written both his letters in one day, he might have saved the trouble of the last one; however, he seems determined not to lose the merit of proving himself wrong, since he cannot prove he is right; but he has bestowed the honour of suggesting the *improvement* to some *intelligent* mechanics, of whom there was not a word till it was proved good for nothing.

I am, yours, &c.

G. M.

Glasgow, 2d May, 1825.

[We have inserted this letter as we received it, although we think our correspondent G. M. has been too severe on our friend in Dollar. We respect them both, and always feel satisfaction in inserting their communications; but we wish to see them always write in temper. This letter was intended to have been inserted last week, but some how or other it fell aside.]

ON MICROSCOPES.

Dr. Goring has caused Mr. W. Tulley of Islington to execute a triple acromatic lens of .333 inches *sideral focus* and .2 inches aperture, *and another of only* .2 inches focus and .11 inches aperture. Used as single lenses, these constitute the utmost perfection to which magnifying glasses can be brought by artificial combination, but their

is too low to be extensively
t. Applied, however, as
glasses, to a compound mi-
e with various apertures
e-glasses, according to the
of the body under examina-
hey render the instrument
o single lenses of the same
ying power, on its capacity
wing the most difficult test
—a degree of superiority
no compound instruments in
a magnified image of an ob-
viewed, instead of the object
ave ever yet attained;* and
equence of the luxurious ac-
dation of their large field of
and the facilities they afford
uminating opaque objects,
itherto been justly rejected
most distinguished naturalists
ur of the simple single lens.
tice to the celebrated Mr.
hton, to whom science is so
ndly indebted on so many
ts, it is proper to observe, that he was the person at whose suggestion achromatic lenses were first made by Mr. Tulley, and which were intended to be applied as the object glasses of the microscopes of Greenwich circle. The lenses in question were a little more than one inch focus, and a quarter of an inch aperture, but were rejected by Mr. Troughton, as no better than common ones, at least for the purpose they were intended for, and with the greatest propriety; for though the chromatic aberration in them was in a great measure subdued, the spherical aberration was still unaltered; their distinctness, therefore, was no greater than that of a common lens of the same angle of aperture. An immense difficulty remained to be overcome, *viz.* the distinction of the aberration of figure, together with that arising from dispersion, which has now been effected. It is but a small point gained to render these lenses free from colour; for they may, notwithstanding, be no better, *or even a great deal worse*, with regard to distinctness, than common ones, as is the case also with the chromatic object glasses of telescopes.

Mr J. Cuthbert has also, (under the direction of Dr. Goring,) constructed a reflecting microscope, on the principle of that invented by Professor Amici of Modena, which, *in its original condition and dimensions*, viz. *with an objective metal of 2½ inches sideral focus*, is good for nothing, notwithstanding the pompous eulogiums which have been bestowed on it; being unable to show any but the most common and easy objects, as can be demonstrated by a very excellent one of the kind previously made by Mr. Cuthbert, in which the objective metal has a truly elliptical figure, &c.* Dr. Goring was of opinion that the

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. Herschell, in a most original and
paper in the Transactions of the
ociety for 1821, Part II. has ascer-
e true theoretical curves for giving
llest quantity of central spherical
n in a magnifying glass composed
enses. Dr. Goring instigated Mr.
s Varley to make that combina-
resented at fig. 5 of the plate at-
o the paper alluded to, on such a
to give a focus of only 1–6th of an
ith 1–15th of an inch of aperture.—
rms the best object-glass for a com-
nicroscope which can be made, (ex-
the achromatus,) to which it ap-
tes very much in point of distinct-
, however, confuses the outline of
and minute transparent objects
ringe of colour, which is very pre-
to vision. As a single microscope,
rms admirably, and may probably
nted on a much smaller scale than
of an inch focus, so as to give a
ful power; as it is, it shows the
of mother-of-pearl, and the fine
flutings on the feathers of moths
rflies, and other test objects which
a power three or four times-higher,
ndered visible *in the common* com-
icroscope of commerce.

* M. Dolland, it is said, has also executed one with the same results.

principle of the instrument was good, but that the failure in the performance arose from the object metal of 2½ inches focus, with a tube 12 inches long, forming an image which was only about three times larger than the object, so that all the rest of the requisite power had to be obtained by very deep eye-glasses: he accordingly planned both the optical and mechanical arrangement for another instrument, which has an objective metal of only .6 inches sideral focus, and .3 inches aperture, with a tube 5 inches long. This being executed by Mr. Cuthbert, was found to perform exceedingly well, and to exhibit any objects which could be seen with the single microscope, to which it seemed equal, power for power.

Dr. Goring has also caused a *diamond lens* of 1–20th of an inch focus, to be executed by Mr. Andrew Pritchard of 51, Upper Thornhaugh-Street, (assistant to Mr. Cornelius Varley, under whose auspices it was worked.) A diamond is well known to be the most refractory body in nature, at least it is the most difficult which could be selected to receive a spherical figure; yet it is possible to form a lens of it, as the event has shown, and (if we neglect the obstacles which present themselves in working it) seems precisely the substance which is most adapted to form a small microscopic magnifier, for its refractive power is nearly double that of glass, while its despersive power is no greater than that of water; its extreme hardness also ultimately causes it to receive the most exquisite figure and polish.—Thus, a diamond lens will always magnify very nearly twice as as a glass one, ground on the tool, while its spherical and matic aberrations are no gr with a given aperture. The in question is plano-convex, was ground on a tool which w have made a glass one of 1- of an inch focus, to which it is cisely similar in size and out figure; it carries the same ape also equally well, (only with peculiarity of magnifying twi much, being very nearly 1–20 an inch focus.) Most unfortu ly, several flaws have appear the stone, which is, moreove present imperfectly polished: nevertheless, capable of acting well, and shows the most dif objects both as a single magn and as the objective-glass of a pound instrument: it has used with as much as 1–20 an inch of an aperture, and e ited to many individuals wh perfect judges of these things. Cornelius Varley (who is exce by no man in his skill in wo small lenses) proposes to ma lens of diamond in the same which would form a glass o 1–60th of an inch focus, (bein smallest lens which can we made,) which will, of course, a focus of about 1–100th inch.

Farther particulars conce the microscopes mentioned i notice, may be had by applyi the artists who have been designated; and a full and pa lar account of each will be giv a work on the microscope, is preparing for the press.— *Jour. Science*, No. XXXVI.

NEWTON AND DESCARTES.

[From Voltaire's Philosophical Dictionary.]

[ALTHOUGH we have the utmost *dislike to the religious* opinions of Voltaire, his acuteness and d mination on other topics, are

iable. We, therefore, with-
sitation, extract his compari-
these two great men—New-
d Descartes.]

SECTION I.

nust be acknowledged that
two great men were exceed-
different from each other in
conduct, their fortune, and
philosophy. Descartes was
vith a brilliant and powerful
ation, which made him a
r man in his private life as
in his manner of reasoning.
nagination was apparent even
philosophical productions,
in every page abound in
g comparisons and illustra-
Nature had nearly made
poet; and he actually com-
for the queen of Sweden, a
tic entertainment, which, to
vantage of his fame was never
l. He engaged for a time
profession of arms; and,
fter he had devoted himself
osophy, he did not think it
thy of him to make love.
istress of his affections was
Francine, who died young;
r loss he sincerely and ten-
regretted. He thus expe-
l all that appertains to hu-
y.

for a long time deemed it
ent to seclude himself from
nd, and especially from his
ountry, in order to philoso-
at perfect liberty. In this he
wisely. The men of his own
were too ignorant to be able
municate to him any know-
and were capable only of
him injury. He quitted
, because he sought for truth,
was at that time persecuted
wretched philosophy of the
s; but he did not find reason
prevalent in the universities
lland, which he chose for
treat; *for at the very time* when the only propositions of his philosophy that were true were condemned in France, he was also persecuted by the pretended philosophers of Holland, who understood him no better than those in his own country, and who, as they saw his glory more nearly, hated his person more bitterly. He was obliged to leave Utrecht; he even experienced the accusation of atheism, that last resource of calumniators; and the man who had devoted all the acuteness of his extraordinary intellect to the discovery of new proofs of the existence of a God, was most absurdly charged with denying him altogether. The various persecutions he sustained, implied extraordinary merit and distinguished reputation, both of which he actually possessed. Athwart the profound darkness of the schools, and the prejudices of popular superstition, a ray of reason pervaded the world. His name at length obtained such celebrity, that rewards were held out to him with a view to his residence in France. He was offered a pension of a thousand crowns. He returned in the expectation of this allowance; but after being at the expense of paying for the patent, (for patents were at that time not given, but purchased,) he never received his pension, and returned to philosophize in his solitude of North Holland, at the time when the great Galileo, at the age of eighty years, was languishing out his life in the prisons of the Inquisition, for having demonstrated the motion of the earth. He at length died prematurely at Stockholm, in consequence of an improper regimen, amidst a number of learned men who were hostile to his opinions or envious of his celebrity, and under the superintendence of a physician who hated him.

The career of Sir Isaac Newton

was widely different. He lived to the great age of eighty-four years, always peaceful, happy, and honoured by his country. It was his great good fortune, not merely to be born in a free country, but at a period when the absurdities of the schools were banished, and reason alone was cultivated; the world could become only his scholar, and not his enemy.

One point in which he may be strikingly contrasted with Descartes is, that in the course of so prolonged a life he felt neither passion nor weakness. He never once associated as man with women, which was expressly stated to me by the physician and surgeon, in whose presence, if not in whose arms, he expired.* Newton may for this excite our admiration, yet Descartes ought not to incur our censure.

The prevailing public opinion in England respecting these two philosophers is, that Descartes was a visionary and Newton a sage. Very few persons in London read Descartes, whose works have in fact become totally useless. Newton also has very few readers, because it requires great knowledge and sense to understand him. Every body, however, talks about them. No merit is allowed to the Frenchman, and every merit is ascribed to the Englishman. There are some who think that the destruction of the old and onc versally received doctrine of na abhorring a 'vacuum;' tha knowledge of the gravity o atmosphere; that the discove telescopes; are all to be attri to Newton: he resembles in respect Hercules in the fabl whom the ignorant gave the of achievements actually perfo by other heroes.

In a critical examination wr at London, of the discourse o de Fontenelle, the author ven to assert, that Descartes was great geometrician. Those wh this language may well be proached with ingratitude to benefactor. Descartes constr as noble a road of science, fro point at which he found geo to that to which he carried Newton himself did after him. is the first who taught the w find the algebraical equatio curves. His geometry, than his powerful and inventive although now become commo familiar, was in his own ti profound, that no professor ve ed to undertake the task of ex ing it, and that there was not a besides Schultens in Holland Fermat in France, who really prehended 'it. He carried spirit of geometry and inve into optics, which under hi came a completely new art; a notwithstanding this, he w some respects entirely mistak is to be remembered that the coverer of new lands cannot in ly become acquainted with all various productions and qua Those who came after him him some obligation at least, s for the discovery. I will not that all the other works of D tes abound in errors.

Geometry was a guide whi had in some degree discovered self, and which would have co ted him safely through his physical researches; he, however, at last abandoned this guide, and gave himself up to the spirit of system. From that time his philosophy became nothing more than an ingenious romance, and at most only probable even to the ignorant philosophers of the day. He was mistaken on the nature of the soul, on the laws of motion, on the nature of light. He admitted the doctrine of innate ideas; he invented new elements; he created a world; he made man on his own peculiar system; and it was truly said, that Descartes's man was a very different being from the real man. He carried his metaphysical errors so far as to maintain that two and two make four, because it is the will of God they should do so; but notwithstanding all this, it is not going beyond the bound of truth to say, that he was estimable and respectable even in his very errors. He was mistaken, but he was at least methodically, consistently, and we may almost say, rationally mistaken. If he invented new chimeras in physics, he at least had the merit of destroying old ones. He taught his contemporaries the way to reason, and how to turn his own weapons against himself. If he did not pay in good sterling money, he at least cried down what was false.

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* This proves that Newton's physician was not so good a natural philosopher as himself. There is no unequivocal proof of such abstinence in man; and a man who dies at the age of eighty-four, whose mind was calm and regulated, and who lived a retired and studious life, may possibly nevertheless have had his weaknesses, although there may be no living witnesses to attest them. Besides, even if Newton had in fact been perfectly unacquainted with the enjoyments in question, what benefit could *possibly have* resulted from it to mankind?—*French Ed.*

Descartes gave an eye to the blind; they saw both the faults of antiquity and of himself; the road opened by him has since become immense. The little work of Rohault constituted, at one period, what was deemed a complete system of natural philosophy; at present, all the collections of the academies of Europe cannot be considered even as the commencement of a system. In attempting to fathom this abyss, we discover infinity.

SECTION II.

Newton was at first intended for the church. He began with being a theologian, and evident marks of his early disposition and studies remained with him through life. He decidedly adopted the Arian, in opposition to the Athenasian system. He even went somewhat farther than Arius, as do all the Socinians. There are in Europe, at present, many learned men of this opinion; I do not say of this communion, for they do not constitute an organized and incorporated association. They are indeed divided by considerable shades of difference among themselves, and many among them reduce their system to simple deism, with the superaddition of christian morality. Newton was not one of this latter description. He differed from the Anglican church only on the point of consubstantiality, and was a firm believer in every thing besides.

One proof of his sincerity is, his Commentary upon the Apocalypse. He discovers in that book that the Pope is Antichrist ,and he explains it also in other respects, like all those who have undertaken the task of interpreting it. It would seem to have been his intention, by this Commentary, to console the human race for his individual superiority.

Many who have read the little that Newton wrote on metaphysical subjects, which he has introduced at the close of his " Principia," have found it quite as obscure as the Apocalypse itself. Metaphysicians and divines may not unaptly be compared to that class of gladiators who were compelled to fight with a bandage over their eyes. But when Newton applied himself with his eyes open to mathematical researches, his views extended to the limits of the world.

He invented what is called the calculation of infinitesimals; he discovered and demonstrated a new principle which produces motion in all nature. Before him, men were unacquainted with the nature of light. False or confused notions were universally entertained concerning it. He said, let light be known, and it was so.

He was the inventor of reflecting telescopes. The first was made by his own hands; and he has clearly shown why the power or reach of the common telescope cannot be increased. It was in relation to his new telescope, that a German jesuit mistook Newton for a journeyman optician; he calls him "an artisan of the name of Newton." Posterity has well avenged him. He was, however, treated with more injustice still in France: he was considered as an unsuccessful and mistaken experimentalist; and because Mariote made use of bad prisms, the discoveries of Newton were rejected.

He was admired by his countrymen as soon as ever his writings and experiments were known. He was not well known in France until after the expiration of forty years. By way of compensation, however, for this long period of ignorance, we had the tubular matter and the ramified matter of Descartes, and the little flimsy vortices of the reverend father Malebranche ,and the system of M. Privat de Moliére, who, however, it must be admitted, was not quite equal to Poquelin de Moliére.

Of all the persons who have lived in society with Cardinal de Polignac, although upon the most slender footing, there is not a man who has not heard him say, that Newton was a peripatetic; and that his colorific rays, and more particularly his attraction, savoured strongly of atheism. Cardinal de Polignac united to all the advantages he had received from nature, very impressive and commanding eloquence, and he made Latin verses with a facility and a success that were astonishing; but he knew nothing of philosophy beyond that of Descartes, and he retained by heart his reasonings just as we are in the habit of retaining dates. He had not become a geometrician, and he was not born a philosopher; he was a competent judge of Cicero's Orations against Catiline, or of Virgil's Æneid, but not of Newton and Locke.

When we reflect that Newton, Locke, Clarke, and Leibnitz, would have been persecuted in France, imprisoned in Rome, and burnt in Lisbon, what are we to think of human reason? Happily she was by this time born in England. In the time of queen Mary, an active and bitter persecution had been carried on respecting the manner of pronouncing Greek; and the persecutors were the party that happened to be mistaken. Those who enjoined penance upon Galileo were more mistaken still. Every inquisitor ought to be overwhelmed by a feeling of shame in the deepest recesses of his soul at the very sight of one of the spheres of Copernicus. Yet if Newton had been born in Portugal, and any dominican had discovered a heresy in his inverse ratio of the squares of the distances, he would, without hesitation, have been clothed in a "sanbenito," and burnt, as a sacrifice acceptable to God, at an "auto-da-fe." *

It has been frequently asked, how it happens that those who by their profession are bound to obtain knowledge and show indulgence, have so frequently been, on the

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* This is as true in fact as piquant in description; and although san-benitoes and autos-da-fe are out of fashion, the disposition to persecute and run down abstract truth is nearly as strong as ever.—*Translator.*

ry, ignorant and unrelenting.
have been ignorant because
had long studied: and they
een cruel, because they per-
that their ill-chosen studies
objects of contempt to the
discerning and wise. The in-
ors who had the hardihood to
mn the system of Coperni-
ot merely as heretical, but
surd, had certainly nothing
prehend from that system.
earth, as well as the other
s, could move round the sun
ut their sustaining any loss
enues or of honour. A dog-
always secure enough when
ssailed only by philosophers.
he academies in the world
roduce no change in the creed
e common people. What, then, is the foundation of that rage which has so often exasperated an Anitus against a Socrates? It is, that Anitus in the bottom of his heart says—Socrates despises me.

When young, I entertained the idea that Newton had made his fortune by his extreme merit. I imagined that the court and city of London had raised him, as it were by acclamation, to be grand master of the mint. Nothing was ever less true. Isaac Newton had a very lovely niece, who happened to please the lord high treasurer, Halifax. His calculation of infinitesimals, and his discovery of gravitation, would have been of no service to him without his handsome niece.

(*To be continued.*)

EMBOSSING ON WOOD.

 and ingenious mode of em-
 on wood has been invented
r. J. Straker. It may be
either by itself or in aid of
, and depends on the fact
f a depression be made by a
instrument on the surface of
the depressed part will
rise to its original level by
uent immersion in water.

wood to be ornamented,
first been worked to its
ed shape, is in a state to re-
the drawing of the pattern;
eing put on, a blunt steel
r burnisher, or die, is to be
successively to all those parts of the pattern intended to be in relief, and at the same time is to be driven very cautiously, without breaking the grain of the wood, till the depth of the depression is equal to the subsequent prominence of the figures. The ground is then to be reduced by plaining or filing to the level of the depressed part; after which the piece of wood being placed in water, either hot or cold, the parts previously depressed will rise to their former height, and will thus form an embossed pattern, which may be finished by the usual operation of carving.

LETTERS AND QUERIES.

To the Editors of the
sgow MECHANICS' MAGAZINE.

TLEMEN,—I was very much
 by your notice of "Mr. Bar-
ethod of correcting observations
 the Compass in Ships," in the
 Mechanics' Magazine, No.
26th March, 1825. The subject is of great importance, but too briefly narrated to be perfectly understood; I therefore hope that you will give a more copious narration, and accompany the same with a plate of Mr. Barlow's machine; which, from your general attention to the observations of your readers, and your uniform practice of making every thing useful sufficiently

plain, I, and many of your subscribers, request you will gratify them with.

I am, yours, &c.

A SHIP OWNER.

Aberdeen, 3d May, 1825.

[We shall endeavour, in an early Number, to attend to the request of this Correspondent.]

GENTLEMEN,—You will greatly oblige a constant reader, by giving the following an insertion in your excellent Magazine. Many emigrants are going at present to South America, which I understand is a very hot country in general, and I think I shall be going myself in a short time: I shall, therefore, be glad if any of your Correspondents will inform me what is the best substitute for ardent spirits, to be taken amongst water, supposing the water to be very unwholesome and dangerous if taken by itself. I understand all mechanics in that country have a regular allowance of spirits per day; from which cause, I believe, many become drunkards, which always prove fatal in a hot climate.

I am, yours, &c.

G. K.

Annan Water, 1st May, 1825.

GENTLEMEN, — Will any of your worthy Correspondents inform me what are the best means for preventing the atmosphere from operating upon the movements of a piano forte; and what will be most efficacious in keeping the beaters from indurating by using?

W. R.

Ayr, 26th April, 1825.

[We shall ourselves take care in future of the other subject of this Correspondent's notice.]

MISCELLANIES.

Subsidence of the Baltic.—A singular and interesting fact has been ascertained respecting the level of the Baltic. It was suspected that the waters of this sea were gradually sinking; but a memoir, published in the Swedish Transactions for 1823, has put the change beyond a doubt. Mr. Buncrona, assisted by some officers of the Swedish piloting establishment, has examined the Swedish coast with great care, from lat. 56° to 62°; and Mr. Halstrom has examined those of the Gulph of Bothnia. The Baltic, it is to be observed, has no tides, and is therefore favourably situated for making observations on its level: but with regard to the periods within which the changes observed have taken place, it was of course necessary to rely on records or on oral testimony, At the latitude of 55°, where the Baltic united with the German ocean, through the Cattegat, no change seems to be perceptible. But from latitude 56° to 63°, the observations show a mean fall of one foot and a half in 40 years, or 4-10ths of an inch annually, or 3 feet 10 inches in a century. In the Gulph of Bothnia, the results are more uniform and indicative of a mean fall of 4 feet 4 inches in a century, or rather more than an inch annually. The Baltic is very shallow at present, and if its waters continue to sink as they have done, Revel, Abu, Narva, and a hundred other ports will, by and by, become inland towns; the Gulphs of Bothnia and Finland, and ultimately the Baltic itself, will be changed into dry land; and shepherds will tend their flocks, and ploughmen drive their steers, and cities and palaces rise up, where now the fishes glide and the billows roar.

NOTICES TO CORRESPONDENTS.

Before we had received G. M.'s second letter, his first had been discovered and sent to the printer with the note at present appended to it. We have no doubt we shall not again require to notice any thing tart in his correspondence, which we assure him we highly value. We shall attend to the request of Mr. Saul of Lancaster, and shall obtain a drawing of the shops in Candleriggs, mentioned by J. P. as being on the same construction with the design he formerly sent: his present communication shall appear next week. L. M'L. at the same time. We have an idea of our own that a monument should be good for nothing else than as a memento of the person to whose memory it is erected; so that although we shall insert his letter, we do not agree with him.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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J. CURLL, PRINTER.

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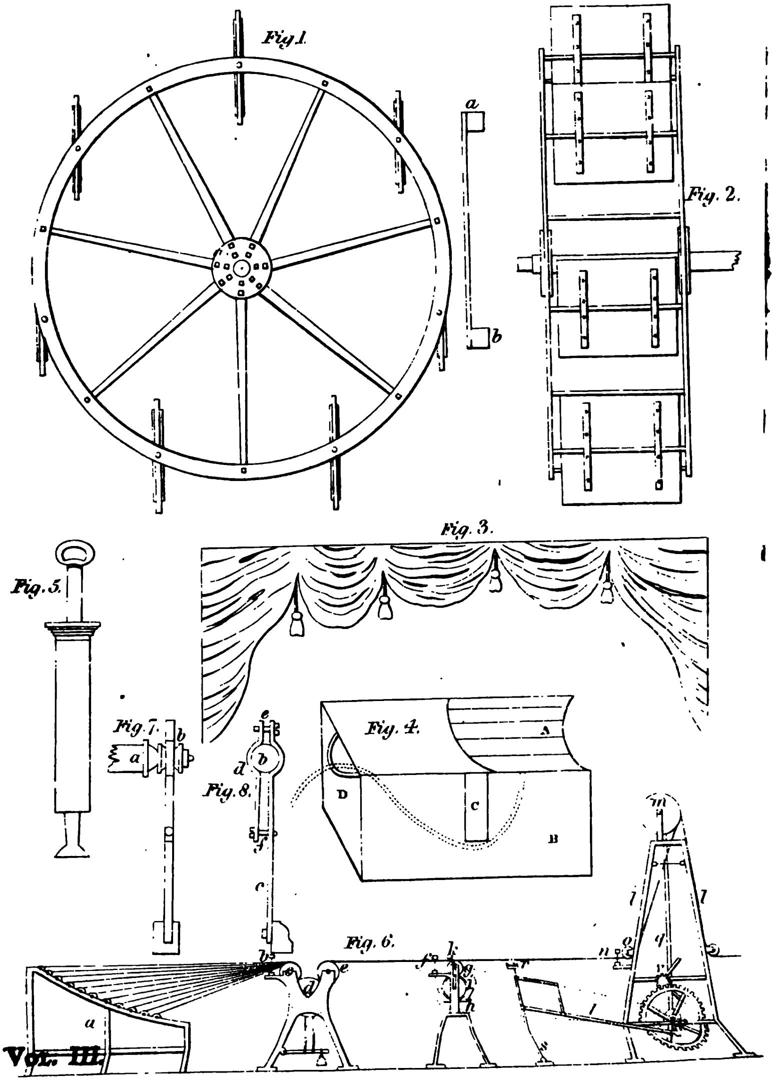
" A little learning is a dangerous thing :
Drink deep or taste not the Pierian spring."

No. LXXIV. *Saturday*, 21*st May*, 1825. Price 3*d.*

IMPROVED STEAM BOAT PADDLES, &c.



Swan Sc

~~Vol. III.~~

STEAM BOAT PADDLES.

GENTLEMEN,—Availing myself of your invitation to mechanics to communicate their ideas, I beg to submit the following:—

My attention has for several years been directed towards improvements in steam boats; and, in common with several others, I have thought the parallel vertical paddles superior to any others, and have invented several methods of giving them the requisite position, a model and drawing of which may be seen at the Royal Institution of Great Britain. As only one of these plans, however, can be claimed by me as original, I shall not trouble you with them; but as that one has been published in the Repertory of Arts for August 1823, without being claimed by any one, I presume it rests with me. Your Correspondent J. S. L. in No. XLV. Vol. II. will find, by referring to your Citizen, Robertson Buchanan's Treatise on Steam Boats, that his plan has been tried before.

My object is effected by the simplest of all means—self-action, and self-adjustment. Let them be constructed with an axis in the middle, the lower half *iron*, and the upper *wood*, coupled together by transverse bars, as seen in the plate, figs.1 & 2. It is evident, if these paddles are hung in the periphery of the frame wheel with sufficient liberty to move freely upon their respective axes, they will, by the gravity of the lower half, maintain a vertical position when suspended in air; and when they are immersed in water, will keep the required position by the action and re-action of the water above and below their centres of motion, aided by the superior weight of the lower half. In case they should exhibit a vibratory motion when above the water, the guide *a b* will correct it, previous to its entering.

It is obvious the form of the paddle may be varied to any shape, provided the axis is in the middle, and the centre of gravity below it. I am fully aware of the theoretical objections to vertical paddles generally; to me they appear inconclusive in practice.

Should any gentleman be desirous of trying the experiment, I have a rough model which shall be forwarded according to directions, and the only return I look for, is a public acknowledgement of its success; or if the model be of any use to you, or the Institution at Glasgow, it is at your service upon pointing out the means of conveyance.

I am, yours, &c.

WILLIAM THOROLD.

Gt. Melton, near Windham,
Norfolk, 6th May, 1825.

ON SHOP WINDOWS, WATER TRAPS, AND REMOVING ECHOES FROM CHURCHES,

By Mr. SAUL of Lancaster.

GENTLEMEN,—It having been fixed at a general meeting of the Lancaster Mechanics' Library, held on the 19th of April last, that a reading-room should be opened the first week of every month, from six ne o'clock in the evening, where the managers and readers should have an opportunity of examining and reading all the new magazines and books which have been purchased for the library, previous to their being lent out; I, on Monday last, was examining those which were lying on the table, and which had that day arrived from London, and, among others, the 16th and 17th Parts of your Magazine, and I perceive in No. LXI. some observations on the design given by me in No. LX. for a shop window.

I assure J. P. that I would have taken it as a favour if he had furnished, along with his observations, a sketch of those windows which have been used twenty-five years, as it would have shown what difference there is between the two, as I had never seen the windows he mentions, or any description of them in any book. I hope J. P. or some of the friends of the Glasgow Mechanics' Magazine will favour you with a correct design of those shop fronts in Candlerigg-Street. I think it would tend to make the Glasgow Mechanics' Magazine still more interesting than it now is, were the improvements in one place thus inserted for the benefit of those residing at a distance; it may be the means of exciting mechanics to attempt improving on those designs.

That I may have the honour of commencing this plan, I send you a design of a water trap, (fig. 4,) which differs considerably from the one given in No. LX. by J. W.; as it is new to me, it may also be new to some of your readers. The plan is simply this, a recess is made below the grate, and a partition fixed from the top, descending below the aperture where the water goes out at to the sewer. It will be easily understood by examining the fig. A is the grate; B, the recess; C, the partition. The dotted line from the top at A to the aperture at D, passing under C, represents the course of the water which is passing from the street into the sewer. It is evident the partition C, which must always dip into the water remaining in the recess, will prevent any smell from ascending.

I shall also endeavour to point out a remedy for the echo complained of by "Nomis," in No, LIX. page 16 of the present volume. which is to hang up a drapery such as is shown in fig. 3, and I have no doubt of its being successful in stopping the echo.

I am, yours, &c.
MATHIAS SAUL.

INSTRUMENT FOR KILLING CATERPILLARS.

GENTLEMEN,—I take the liberty of sending you an outline of an instrument for destroying caterpillars, which for several years I have used with success. It is much simpler in its construction, may be procured at much less expense,* than any instrument for this purpose I have yet seen, and will answer the purpose equally well. It operates exactly the same as a common syringe, and is made the same shape, with this difference, that its mouth is broad and full of small holes, like the mouth of a watering can; it may be made, for ordinary sized gardens, to hold about a Scotch pint. If water is heated to 140°, and this instrument filled with it, (which may be done by putting the rose into a basin of water and drawing the handle upwards,) and expended upon those trees where the caterpillars are, they will instantly fall off lifeless. The sketch, fig. 5, will show the appearance of the instrument, and make it quite intelligible. Trusting that this may be useful to some of your country friends, I am,

Yours, &c. D. C.

Parkhead, 12th May, 1825.

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* The price of my one was 3s. 6d.

HORROCKS' IMPROVEMENTS IN PREPARING WARP.

To William Harwood Horrocks, *of Portwood within Prinnington, in the County of Chester, Cotton Manufacturer, for his Invention of a certain New and Improved method applicable to Preparing, Cleaning, Dressing, and Beaming Silk-Warps, and also applicable to Beaming other Warps.*

[Sealed 24th July, 1823.]

The intention of the patentee is to perform the several operations of preparing, cleaning, dressing, and beaming warps for the weaver, at one and the same time, in a machine, or combination of apparatus, such as is exhibited, in a side view, fig. 6. The silken, or other threads of which the warp is to be formed, are to be drawn from a series of bobbins placed on horizontal axles in a stand as usual, shown at *a*. These threads converge and pass through the reed, *b*, the whole series of them forming in width a broad flat shed, equal to the breadth of the intended warp. After passing the reed by which the threads have been formèd into a warp, they proceed over the small roller, *c*, and under the large roller, *d*; the circumference of this roller is to measure the quantity of the warp passed under it, which is to be indicated in yards by a dial and counting apparatus attached to its axle. From the under side of the roller, *d*, the warp passes upwards over the small roller, *e*, from whence it proceeds to the dressing or sizing rollers.

Previous to the operation of dressing, *i. e.* stiffening or sizing, the warp must be cleaned by picking in the usual way; this is to be done in the space over which the warp is extended between the carriage of the rollers, *c*, *d*, *e*, and the sizing apparatus; *f*, is a second reed, through which the threads of the warp pass, and *g*, is a small roller intended to communicate size or gum to the under side of the warp; *h*, is a trough containing the stiffening matter; and *i*, is a roller covered with cloth, or other absorbent substance, turning round in the trough, which, by its rotation, delivers the size or gum on to the periphery of the upper roller, *g*, to be communicated to the warp as it passes over that roller; *k*, is a small roller, the pivots of which are suspended in arms extending from the ends of the axle of the roller, *g*. The intention of this roller, *k*, is to keep the warp down in contact with the sizing roller, and by the pressure which it gives, a greater or less portion of the surface of the sizing roller will be embraced by the warp.

The standard, *l*, *l*, supports the warp-beam, *m*; and from the sizing apparatus the warp is conducted through the reed, *n*, and under the guide roller, *o*, to the warp-beam. The rotation of the warp-beam, by which the warp is drawn forward through the several machines, is effected by the revolution of the axle, *p*, turned by a rigger and band communicating from the working part of a steam-engine, or other first mover. Upon the end of this axle, *p*, a bevel-wheel, or endless screw, turns the vertical-shaft, *q*, and that, by a similar contrivance at the top, turns the warp-beam, *m*, and causes it to wind the warp.

In order to spread the stiffening matter uniformly upon the warp-threads, a brush, *r*, is placed upon the top of a vibrating rod, *s*, near the sizing apparatus. This rod, which moves upon a centre, is actuated by means of a crank, *t*, upon the end of the shaft, *p*; and as that shaft goes round, the brush is made to traverse to and fro under the warp, and thereby to spread the gum or other stiffening matter uniformly upon the threads. For the purpose of assisting in drying the warp, a flyer, *v*, is placed in the standard, and made to revolve by means of a pinion upon the end of its axle, actuated by a toothed-wheel on the shaft, *p*; the rapid rotation of this flyer circulates the air against the surface of the warp as it rises up to the warp-beam and greatly assists in drying it.

Another series of apparatus, exactly similar to that just described, for preparing, cleaning, dressing, and beaming the warp, is proposed to be placed on the opposite side of the main standard, *l*, by which means the process may be doubled, that is, two warps may be prepared at one time.

As it may not be possible always to prepare the exact quantity of warp required for a certain loom, the patentee proposes to divide the threads dressed at one operation into equal portions, so that any number of those portions may be taken up upon distinct rollers, and drawn off in a detached machine on to the warp-beam, which may be thence removed by the weaver to the loom, and another beam placed in its stead, to be charged with warp in a similar manner.

[Inrolled, January, 1824.]

To WILLIAM HARWOOD HORROCKS, *of Stockport, in the County of Chester, Cotton Manufacturer, for his New Invented Apparatus for giving Tension to the Warp in Looms.*

[Sealed, 15th June, 1824.]

THERE have been various contrivances for giving tension to the warp in looms, by means of weights suspended to cords, which pass round the warp-beam; by gear actuated by a ratchet and pall connected to the lay; by a series of wheels and levers, as in Stansfeld's patent, and several other modes. The present improvement is a method of restraining the delivery of the warp by friction, and consists of a hoop embracing a wheel at the end of the warp-beam.

Fig. 7, represents the end of the beam or warp-roller, *a*, upon which a wheel or pulley, *b*, is fixed. Fig. 8, shows a section of the same, exhibiting the end view of the hoop or clasp which embraces the pulley; *c*, is a standard of iron, with a semicircular bend at top, which standard is made fast at bottom to a block stationed on the ground; *d*, is a corresponding piece of iron with a semicircular bend, which is attached to the standard by screw bolts at *e* and *f*. It is hence obvious, that according to the screwing up of the bolts, so will the pulley be pressed by the two semicircular bends or hoop which embraces it, and as the warp is drawn off by the work-roller in front of the loom, the pressure of the hoop against the periphery of the pulley, will create so much friction as to restrain the turning of the beam or roller, *a*, and thereby keep the warp threads at a proper tension.

[Inrolled, December, 1824.]

NEWTON AND DESCARTES.

[Continued from No. LXXIII. page 239.]

SECTION III.—*Of the reformed Chronology of Newton, which reduces the age of the world five hundred years.*

I HAVE still to speak of another work, more within the comprehension of mankind in general, but which at the same time is distinguished by that creative mind which Sir Isaac Newton carried with him into all his researches. This is a perfectly new chronology; for in everything that he undertook, he appears to have been destined to change the ideas which had been adopted by other men. Accustomed as he was to reduce chaos to order, he endeavoured to shade at least some light on the chaos of ancient fable and history, and to fix a chronology before exceedingly doubtful. It is incontestible, that no family, city, or nation, ever existed that was not desirous of placing its origin as far back in antiquity as possible. The earliest historians, moreover, are the most careless with respect to dates. Books being infinitely less common than at present, and, consequently, incalculably less exposed to criticism and detection, mankind were deceived by authors almost with impunity; and as facts have evidently been fabricated, it can scarcely be doubted that dates have likewise been so. On a general view, Sir Isaac Newton considered the world five hundred years younger than chronologists supposed. He founds this conclusion on the usual course of nature, and also upon astronomical observations.

By the course of nature is here meant the average number of years allowed to the successive generations of mankind. The Egyptians were the first who adopted this uncertain method of computation, when they were desirous of recording the early events of their history. They reckoned three hundred and forty-one generations from Menes to Sethon; and as they had no fixed dates, they considered three generations as equivalent to a hundred years. Accordingly, from the reign of Menes to that of Sethon, they reckoned eleven thousand three *hundred and forty* years. The Greeks, before they adopted the system of the Olympiads, followed the same method of the Egyptians, and extended farther the duration of generations, carrying each to the length of forty years. In this point, however, both Egyptians and Greeks were mistaken in their calculation. It is perfectly true that, according to the usual course of nature, three generations would extend to about a hundred and twenty years; but it is very far indeed from being true, that three reigns would comprise that number of years. It is perfectly evident in general, that men live a much longer time than kings reign. Accordingly, a man desirous of writing the history of any country, but who had no access to correct dates, who knew, however, that there were nine kings who had reigned over it, would commit one of the grossest errors in computing these nine reigns as extending to three hundred years. Every generation is about thirty years, every reign is about twenty, one with another, or, according to the common expression, on the average. Take, for example, the thirty kings of England, from William the Conqueror to George I. and we shall find they reigned, on the whole, six hundred and forty-eight years; which amount divided by thirty, will give to each individual reign twenty-one years and a half. Sixty-three kings of France reigned each, upon the average, about twenty years. Such is the ordinary course of nature. The ancients, therefore, were mistaken in equalizing the duration of three reigns to that of three generations; they allowed too long an average duration to a reign; and their allowance, therefore, must be proportionally reduced.

Astronomical observations seem to furnish our philosopher with more powerful and decisive support.

He appears strongest when contending on his own territory. We know that the earth, besides its annual movement, which carries it round the sun from west to east in the space of a year, has a farther and singular revolution, rather suspected than ascertained until very modern times. Its poles have a very slow retrograde motion from east to west; the consequence of which is, that every day their position does not correspond precisely to the same point of the heavens as it did the day before. This difference, which is imperceptible in a single year, becomes very distinguishable and striking in time; and at the end of seventy-two years, the difference is found to amount to a degree, that is, the three hundred and sixtieth part of the whole circle of the heavens. Thus, after seventy-two years, the colure of the vernal equinox, which, previously to the commencement of that period, passed through one fixed star, corresponds to another fixed star one degree distant from the former. Hence it arises that the sun, instead of being in that part of the heavens where the ram was in the time of Hipparchus, is found to correspond now to that part of them in which the fishes are placed; and that the twins are now where the bull was then. All the signs have changed place; but notwithstanding this change, we still use the same language as the ancients in speaking of them. We say, the sun is in the ram in spring, accommodating our language to natural appearances, in the same manner as when we say, the sun revolves from east to west.

Hipparchus was the first among the Greeks who perceived any change in the constellations in reference to the equinoxes, or rather who learnt it from the Egyptians. The *philosophers attributed this motion to the stars;* for at that time no one suspected such a revolution in our earth. That was thought in every sense immoveable. They, therefore, created the heavens, to which they attached all the stars, and attributed to these heavens a particular motion which made them advance towards the east, while all the stars appeared to take their daily course from east to west. To this error they added another, of much more consequence. They imagined that the pretended heavens of fixed stars advanced one degree towards the east in a hundred years. Thus they were mistaken in their astronomical calculation, as well as in their system of natural philosophy. For example: an astronomer of that period would have said, The vernal equinox, at the time of a certain observer, was in such a sign, and at such a particular star; it has moved two degrees from the time of that observer to our own; but two degrees are equivalent to two hundred years; that observer, therefore, lived two hundred years before me. It is certain, that an astronomer who had proceeded upon such calculations would have been mistaken by about fifty years. It was on this account that the ancients, thus doubly deceived, composed their great year of the world, that is to say, of the revolution of the whole heavens, of about thirty-six thousand years. But the moderns know that this imaginary revolution of the heaven of stars is nothing but the revolution of the poles of the earth, which is accomplished in twenty-five thousand nine hundred years. It is proper to remark, as we proceed, that Sir Isaac Newton, in determining the figure of the earth, has very ingeniously and successfully explained the reason of this revolution.

These premises being admitted, it remains, in order to settle chronology, to ascertain through what star the equinoctial colure divides the ecliptic in spring, at present, and to try to discover whether some ancient writer or other does not inform us in what point the ecliptic was divided by that colure in his time. Clement of Alexandria relates, that Chiron, who belonged to the expedition of the Argonauts, observed the constellation at the period of that celebrated expedition, and fixed the vernal equinox in the middle of the ram, the autumnal equinox in the middle of the scales, and the solstice of our summer in the middle of Capricorn.

Long after the expedition of the Argonauts, and one year before the Peloponnesian war, Meton observed, that the point of the summer solstice passed through the sixth degree of Cancer.

But every sign of the zodiac consists of thirty degrees. In Chiron's time the solstice was halfway in the sign, that is, at the fifteenth degree; a year before the Peloponnesian war, it was at the eight; it had, therefore, retrograded seven degrees—(a degree is equivalent to seventy-two years); therefore, from the beginning of the Peloponnesian war to the expedition of the Argonauts, there were no more than seven times seventy-two years, which the Greeks state to have been in fact the case. Thus, comparing the state of the heavens at present with the state in which they were at that time, we perceive that the Argonautic expedition ought to be placed nine hundred years before Jesus Christ, and not about fourteen hundred; and that, consequently, the world is not so old as was imagined by about five hundred years. By this mode of computation all events are brought nearer to each other, and every historical fact took place at a later period than it was stated to do. This system appears to be correct: I am unable to state how far it will succeed, and whether men will be induced to reform the chronology of the world upon the principles here explained. Perhaps the learned might consider it too much to concede to one individual the glory of having perfected at once natural philosophy, geometry, and history; this would be admitting a species of universal monarchy, which self-love can scarcely allow without great reluctance. Accordingly, at the time that the partizans of 'vortices' and tabular matter attacked the demonstrated doctrine of gravitation, the reverend fathers Souciet and Freret wrote against the chronology of Newton, even before it appeared from the press.

ESSAYS ON BLEACHING,*

By James Rennie, A. M. Lecturer on Philosophy, &c. &c., London.

No. I.—HISTORY OF THE ART.

SECTION I.

Bleaching may be defined the art of whitening cloth, and other articles of manufacture, by depriving them of such colouring materials as shall naturally or accidentally adhere to them. The slightest acquaintance with the operations and instruments of this art, will be sufficient to show that it has little dependence on mechanical principles, and that it is almost wholly to be referred to those of chemistry. In an inquiry, therefore, into the improvements which have been made in bleaching, it will be necessary to bear this in mind in explaining the modes of operation, and accounting for the changes produced by the agents which are employed. From this view of the subject it will be evident, that it opens an extensive field for scientific discussion and research, in which the general scholar may receive much interesting knowledge, and the manufacturer important and indispensable information. The Essay will be most naturally and conveniently arranged, by treating, first, of the history of the art; then, considering the apparatus, the agents, the substances to be operated upon, and the processes, in their order; and lastly, by examining the theories of the art which have been proposed.

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* We are sorry Mr. Rennie's distance prevents the possibility of his seeing a proof of *this Essay*; should any of our friends perceive that any typographical inaccuracies have *crept in, we hope* they will excuse them on this account, and correct them with their pen.

Our knowledge of the arts exercised in the earlier ages of the world must always be scanty and imperfect, as the records which contain the narrative of wars, revolutions, and the extraordinary phenomena of nature, are employed with matters of too high import to descend to delineations of the peaceful arts exercised in the calm of domestic privacy. In the infancy of letters also, men of genius were either poets, historians, or lawgivers, and none thought the arts of sufficient interest to engage their attention. All our information, therefore, of the arts of antiquity, must be derived from the writings of those three classes of authors, and must consist chiefly of incidental circumstances and allusions which they may happen to mention.

The earliest writings which have been preserved, contain such circumstances and allusions as leave no doubt that the manufacture of cloth was understood in the time of their authors. In Job, which is considered to be the most ancient book now extant, there is a very striking illustration of the transitory nature of human life, taken from this art, and the very allusion indicates that it was practised with much expedition: "My days," says he, "are swifter than a weaver's shuttle." So early also as the time of Abraham, some kind of tape or inkle seems to have been made, if the passage, "I will not take a thread even from a shoe-latchet," is properly rendered. That the manufacture of cloth in the East was in a considerable state of advancement at an early period, appears also from the circumstance that veils were worn by the women as at present. For example, Abimelech says to Sarah that Abraham was to her "a covering of the eyes:" Rebekah also covered herself with "a veil" when she first saw Isaac.[1] "Fine linen"[2] is mentioned in the book of Genesis as a part of the courtly ornaments which Pharaoh bestowed upon Joseph; and, it may be inferred from this, that the Egyptians used flax in preference to cotton or any other material as an article of dress. Wool was prohibited[3] on account, as Ezekiel says, "of its causing sweat," and not only so, but the Egytians held "every *shepherd* in abomination." (Gen. xlvi. 34.) A mixture also of woollen and linen was forbid by the Mosaic law, (Deut. xxii. 11.) and probably for the same reason. We find also that "fine twined linen" is very frequently mentioned by Moses in the decorations of the tabernacle, and commanded for the vestments of the Levites. Ezekiel mentions "linen bonnets for the head, and linen breeches for the loins." But we are not entirely left to conjecture concerning the "fine linen of Egypt," as we possess specimens of it which, although injured by time, are still sufficiently preserved to show its texture; I refer to that which enwraps the Egyptian mummies, and of which specimens may be seen in the Hunterian Museum. In an account of a mummy in vol. 54 of the Philosophical Transactions, Dr. Hadley says, that when the outward painted covering was removed, nothing was to be seen but linen fillets which enclosed the whole mummy, the uppermost of which were of a degree of fineness equal to what is sold in the shops under the name of long lawn, and the weaving seemed to have been executed in the manner of Russian sheeting. This mummy was taken from the catacombs of Cairo. The mummy of an Ibis in the London Museum, which I examined with some attention, was wrapped in linen of a dark brown colour, and of a very open fabric, similar to what we denominate gauze. The threads were very evenly and uniform, and the distance between them seemed to be mathematically exact; so far as I could judge, it seemed to have been wrought in what our mechanics would call a 600 reed, that is, 600 threads of warp to the yard. This sufficiently shows that the Egyptians were considerably advanced in the art of making linen at a very early period, as the chronology of the mummies is by all accounts of great antiquity. The invention itself is ascribed to one of their kings. (Clem. Alex. Strom. I. 225.) We know farther, that the manufacture must have been extensive, as it was made an article of export, and the crops of flax, which yielded, according to Pliny, (xix. 1.) four sorts of linen, are mentioned in conjunction with those of barley, in the account given by Moses of the plagues of Egypt.[4]

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[1] See Branius de Vest. Sac. Hebr. p. 250, &c.

[2] Some very learned authors, as Calmet and Goguet, have thought that cotton rather than linen is here meant, and rest their proof upon a passage of Pollux, (De Vit. Apollon. II. 20.) in which he describes the *Byssus* (the word by which שש is commonly rendered) to be a down extracted from a nut and spun for garments; and on a passage in Pliny, (Hist. Nat. XIX. 2.) where he says, that cotton robes were very early used in Egypt, and were worn only by persons of distinction. But this does not amount to proof; for if this were the case, for what purpose did the Egyptians cultivate flax to a considerable extent? The most ancient mummies, also, are wrapped in linen. The learned Bachart (Phaleg. III. 4.) thinks that the Byssus was a sort of fine flax. Vossius (ad Pomp. Mela) thinks it was silk; Gesner (Thet. Armin.) that it was a marine production.

[3] *'Ου μεν τοι ἐς γε τα ἱρα ἐσφερεται ἐιρινεα ὀυδε συγκαταθαπτεται σφι' ὀυγαρ ὁσιον.* Herodot. II. 81.

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[4] India also was anciently, as well as at present, celebrated for its manufactures of cotton, linen, and silk, and for tingeing these with variously-coloured flowers and figures; which implies that they were also acquainted with bleaching: for dyeing can never be perfect without previous bleaching. We may infer this from what Pliny says: "Pingunt et vestes Ægyptæ inter pauca mirabili genere, *candida vela* postquam attrivere illinentes non coloribus sed colorem sorbentibus medicamentis." (Hist. Nat. XXXV. 11.) Of the dyeing, however, we are sure.

Jam oschleis homines junctos, et quidquid inane
Nutrit, in Atalicis quæ pingitua India *velis*.
Claud in Eutrop. I. 356.

In this passage, as in Pliny, XIX. 1, *velis* seems to signify linen; and we have no warrant to follow Heinsius in reading *telis*, i. e. *tapestry*, *carpets*. This, however, is placed beyond dispute, as it regards the manufacture, by Quint. Curt. (VIII. 9.) who says, "terra (Indiæ) lini ferax, inde plerisque sunt vestes;" and again, "Indi, corpora usque ad pedes *carbaso* velant; solvis pedes capita *linteis* vinciunt:" and Strabo, who mentions the Σινδονες ἐυανθεις, the finely flowered linens of the Indians. Now, Σινδων, we are assured by Hesychius, signifies λινᾶ ἱματια. The cultivation of flax, indeed, was much attended to, and the season for sowing it, and the soil best adapted to its production, were known even to foreigners: Εκ δε τῆς ἀναθυμιασεως τῶν τοσουτῶν ποταμῶν, και ἐκ τῶν ἐτησιων, ὡς Ἐρατοσθενης φησι, βρεχεται τοῖς θερινοῖς

But although we find many notices both in the Jewish and Heathen antiquities, of the manufacture of linen cloth, there are extremely few of any of the processes used for finishing it by washing or bleaching. In the time of Job, the different qualities of water, as to its power of cleansing, seem to have been known, if we do not consider the passage, "though I wash myself with snow-water," to have merely an emblematical reference to the whiteness of snow, rather than to the properties of the water. The prophet Malachi uses a figure, however, which leads us to believe that some method of whitening cloth was used in his time. He compares the scrutiny which Jehovah makes into the affairs of men, to "the refiner's fire and *fuller's soap.*" Borith and the best commentators are of opinion that this "soap" was the natron at present used for the purposes of bleaching in several countries in the East: of which Dr. F. Buchanan gives some account in the first volume of his journey to Madras. In the Apocalypse, "fine linen, clean and *white,*" is made an emblem of righteousness and purity, and in the same book, "white raiment" is mentioned in conjunction with "gold tried in the fire," intimating that it had undergone some analogous process of purification.[5]

Before the Apocalypse was written, however, we know that bleaching was practised by the Romans, and in all probability they would derive it from some of the nations more advanced in refinement than themselves. This conjecture is rendered the more probable, that the use of linen was regarded by many of the Romans as an unpardonable luxury, and those who piqued themselves upon preserving the ancient severity and simplicity of manners, boasted that they had never degraded themselves by such effeminate apparel. Indeed it is not unlikely

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ὀμβρεις ἡ Ἰνδικη, και λιμναζει τα πεδια· ἐν μεν ὀυν τουτοις τοις ὀμβροις λῖνον σπειρεται· (Strabo, XV. 690.) Their manufactures of this kind they both used themselves:

Προς δ' ἀυγας Ἰνδῶν ἐρατεινη πεπταται ἀια
—— ὁι δ' ἰσους ὑφοωσι λινεργεας·
Dionys. Perieg. 1116.

and exported in great quantities: Μητροπολις δε της χωρας Μινναγαρα, ἀφ' ἧς και πλειστη, Ὀθονιον εἰς Βαρυγαζαν καταγεται· Arriani Periplus Mar. Eryth. The same author has many passages of a similar import, in the pages subsequent to this. Can Vassius, then, be serious, when he says, "Sic sentio, ubiumque apud veteres aut lanæ, aut lini, aut byssi Indici mentir fit, intelligendum id esse de serico." (ad Pomp. Mel. III. 7.) In these countries, likewise, cotton was cultivated and manufactured: Τα δε δενδρεα τα ἀγρια ἀυτοθι φερει καρπον καλλονῆ τε προφεροντα, και ἀρετῆ τῆ ἀπο τῶν ὀϊων· και ἐσθητι ὁι Ἰνδοι ἀπο τουτων των δενδρεων χρεωνται· Herod. III. 106. Nay, in some parts of the East, they prefer cotton to linen, although they have abundance of flax: "Fontes les campagnes (Dans la Georgie) sont converties de cette Plante (de Lin.); mais ou ne la cultive que pour la grieme car au jette la tige sans la battre pour la fillet: quelle perte! ou en feriot les plus belles toiles du monde: peutetre ansi que ces toiles feroient grand tout a leur commerce de toiles de coton." (Tournif. Voy. du Levant. XVIII. *p.* 174.)

[5] Other illustrations of white being accounted an emblem of purity and righteousness, occur in several of the ancients. Τους δε λευκους, και ου νοθους τα ἐνδον, λευκαις και ἀπεριεργοις ἁρμοδιωτατον ἐσθησι χρησθαι; (Clemens Alex. Pædagogus. II. 10.) *i. e.* *white* and plain raiment is the most consonant to men of clear consciences of genuine internal piety. Ἐιρηνικοις ἀρα ἀνθρωποις και φοτεινοις καταλληλον το λευκον; (Id. III. 11.) *i. e.* *white* is the best colour for the peaceable and the illuminated. Clemens wrote in conformity to a Platonic doctrine: Ὑφην δε μη πλεον ἐργον γυναικος μιας ἐμμηνον· χρωματα δε λευκα πρεποντ' ἀν θεοις ἐιη, και ἀλλοθι, και ἐν ὑφη· βαμματα δε μη προσφερειν, ἀλλ' ἡ προς τα πολεμου κοσμηματα. (Plato. de Repub. XII. 691. edit. Ficini.)

that in this, as in most other arts, they had the Greeks for their masters, who, we know, had some method of bleaching by means of lime. This we learn from Theophrastus, who wrote 300 years before Christ. He relates that a ship loaded with linen and *lime for bleaching it*, was destroyed by the accidental access of water to the lime. It may be inferred from this, that they used the lime in a caustic state, and not as a simple earth, as this cargo must have consisted of burnt limestone for the water to have rendered it capable of destroying the vessel.[6]

But however ignorant we may be of the processes followed by the nations of antiquity for whitening their linen and cotton garments, we are sure that they did employ some efficient mode. For the wrappings of the mummy in the Hunterian Museum, injured as they must be by time, are much whiter than any unbleached linen with which we are acquainted. The fairest specimens are of the colour which Werner would call yellowish or brownish white—our whitest linens he would denominate greyish or
ish white. Most probabl
Egyptians employed natron f
purpose of bleaching. "It
soon be observed, indeed, th
action of water, together wit
of the sun and air, rendered
whiter than such as had bee
cently manufactured; and sinc
first step towards refinement
add beauty to utility, as the
of society improved, a desire t
duce cloth of a pure and sp
white would naturally arise."
simple modes of whitening cl
would thus naturally be discov
are alluded to by Job, (ix.
who speaks of washing with
rendered by Junius in loco, s
mate, and supposed, by Go
(I. 132,) to be *saltwort;* an
Homer, the most ancient hea
author now extant, in the S
Odyssey, where Ulysses finds
sicaa with her maidens empl
in washing their garments,
bleaching them in the sun.[7]
learn from Herodotus also,
the Babylonians wore tunic
lawn which descended to
feet, and that the art of ble
ing these and of staining them
different colours was similar to
still practised in India. (See li
N. 195, and Goguet III. p. 18

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[6] May not the Greeks, in their turn, have learned this, along with the other processes of manufacturing linen, from the Colchians or the Egyptians, with whom they carried on a considerable linen trade? Λῖνον μοῦνοι οὗτοι (πολλοι) τε και Αιγυπτιοι ἐργαζονται κατα ταυτα· λῖνον δε το μεν κολχικον ὑπο Ἑλληνων Σαρδονικον κεκληται· (Herodot. II. 105. See also Strabo, XI. 498.) The same commerce seems to have been carried on between the Egyptians and the children of Israel: "And Solomon had horses brought out of Egypt, and *linen yarn:* and the king's merchants received the linen yarn at a price." 1 Kings x. 28. Now, this linen being of a bright clear white, must have undergone some effectual process of bleaching: "Tunc influunt turbæ sacris divinis initiatæ, viri feminæque omnis dignitatis et omnis ætatis, *linteal vestis* CANDORE PURO LUMINOSI." (Apuleii, Metam. XI.)

[7] Some of the ruder tribes lay
clothes among dung, the alkali of
acts as a detergent, and then wash th
water. (Goguet, I. 132.)

[8] We are told by Arrian, that th
ton cloths of India and Persia were d
guished for their whiteness: Ἐσθῆτι δ
λινεῃ χρεονται, καθαπερ λεγει Νεαρχος,
τοῦ ἀπο τῶν δενδρεων, ὑπερ ὅτου μοι ἤδη λ
ται· το δε λῖνον τουτο, ἡ ΛΑΜΠΡΟΤ
την χροιην ἐστιν ἀλλου λινου παντος· ἡ μ
ἀυτοι ἐοντες ΛΑΜΠΡΟΤΕΡΟΝ ΤΟ Λ
φαινεσθαι ποιουσιν· (Reb. Indic.)
Persia, several kinds of earths and
are used in bleaching, as we learn
Chardin, (IV. 113.)

ON THE HEIGHTS OF MOUNTAINS.

ENTLEMEN,—I enclose you a
, containing the extent of the
le horizon from the elevations
ified in the first column.—
ld you think it will prove in
way interesting to your readers,
at your service. The heights
to the mountains are taken
the best authorities. Those
h are the result of barometrical
urement, are marked B. The
are the result of geometrical
urement. With regard to the
nse altitude now ascribed to
Himalah mountains on the
of Indostan, there are differ-
pinions. Some eminent ma-
ticians think that future mea-
ments will bring them down so
make them nearly on a level
Chimboraza, which has long
imagined the highest on the
; but those who have any re-
upon the recent accounts
India respecting them, will
the stupendous accounts as-
d them in the table as nearly
ct. Jamootri is not the high-
or Dhawalagivri, or the White
ntain, is said to tower to the amazing height of 26,862 feet, which is a little more than five miles.

It may perhaps enable your readers to appreciate the table better, to mention that the extent of the visible horizon to an eye situated five feet eight inches above the level of the sea, is very nearly three miles. To determine what places are situated within the limits of the visible horizon of any place, with the assistance of a map, is an easy process. Take from the scale of the map a radius equal to the extent of the horizon, and from the given place as a centre describe a circle, and all those places within the circumference are included in the visible horizon of the place. It has thus been determined that the visible horizon for the top of Ben Nevis extends to about Tain, Forres, Kinross, Dunfermline, Bothwell, Brodick, and includes a great part of Islay, and the whole of the island of Skye.

I am, yours, &c.

Q. Z. D.

Glasgow, 27th April, 1825.

TABLE.

Names.	Situation.	Height in Feet.	Extent of the visible Horizon in miles.
Tintoc,	Lanarkshire,	2,306	58.813
Heibh Donard,	County of Down,	2,786	64.645
Goat Fell,	Isle of Arran,	2,865	65.565
Helvellin,	Cumberland,	3,055	67.694
Benlomond,	Stirlingshire,	3,191	69.181
Snowdon,	Caernarvon,	3,571	73.188
Ben Lawres,	Perthshire,	3,944	79.915
Ben Nevis,	Invernesshire,	4,358	80.852
City of Mexico,	Spanish America,	7,476 B	105.896
Peak of Lomnitz,	Austria,	8,870 B	115.347
Etna,	Sicily,	10,963 B	128.236
Mount Perdu,	Pyrenees,	11,283	130.094
Peak of Teneriffe,	Canary Isles,	12,358 B	136.151
Mont Blanc,	Switzerland,	15,646	153.196
Chimborazo,	Peru,	21,440 B	179.332
Jamootri,	N. of Indostan,	25,500	198.116

THE SUN-DIAL.

WHY is it almost everywhere vanished? If its business-use be superseded by more elaborate inventions, its moral uses, its beauty, might have pleaded for its continuance. It spoke of moderate labours, of pleasures not protracted after sunset, of temperance, and good hours. It was the primitive clock, the horologe of the first world. Adam could scarce have missed it in Paradise. the measure appropriate fo plants and flowers to spring the birds to apportion thei warblings by, for flocks to and be led to fold by. Th herd "carved it out quaintl sun," and turning philosop the very occupation, prov with mottos more touchin tombstones.

PERSPIRATION OF PLANTS.

As soon as the leaves of plants expand, *insensible perspiration* takes place, which is very abundant on some plants. The *helianthus annucus* or sun-flower, emits seventeen times as much perspiration as the human body, and the *cornelian cherry*, or *cornus masculus*, evaporates, in 24 hours, twice the of the whole shrub. This resembles the insensible pers of the human frame, which off about five pounds daily, from the pores of the skin the lungs.—*Mr. Wheeler's at the London Mech. Instit*

LETTERS AND QUERIES.

WATT'S MONUMENT.

GENTLEMEN,—Of the subscription to Watt's Monument, the proceeds, we find by a recent article in the public prints, amount to £3086 6s. 7d.—a sum, one would think, sufficient to rear a very *decent* monument. To this monument, Gentlemen, *we*, in common with other mechanics, are a *mity* contributor; therefore, 'tis but natural that we should feel a little anxious of what sort or species the monument is to be. £3086, not to speak of the 6/7, is not to be misapplied.

Of a monument, if we know any, the drift and design is to preserve the memory of the dead. But we are very apt to forget a person when we cease to feel under obligation to him: *ergo*, that monument answers the purpose best which will, if possible, keep us under perpetual obligation. The query then suggests itself—shall an *obelisk* answer this noble purpose? Yes: if to occupy half a district of good arable ground—if to over-burden the creation—if to threaten "hideous fall one day upon our heads," does it, then an obelisk is just the thing. Will a statue in bronze answer the end? A statue! for our own part if we wanted the name and memory of the ru murdered our father, we think would answer the purpose mos ably. An object for clamorous absence of the moon to bark at and mark for wanton boyhood for every foul and filthy bird upon! Strange mode of doing h one's memory!

For our own part, Gentlemen subject of this nature, when we reason, we discard all secular an views and motives, we speak and honestly; therefore, fearles undue imputation, we would hu commend a *House or Hall for t the Mechanics' Institution*, as monument to the memory o Watt. This, Gentlemen, will ing monument—a speaking m —a monument worthy of the n such a monument Watt may be to exist—may be said to be parent and patron of Fine Art still training his *hobby*, the stea to new feats, new exploits, new ments.

This house or hall, Gentlemen, we would have by no means cast in a common mould; a statue, an obelisk, or both may be easily superinduced; this part of it, however, we leave to some more prolific genius to concert: there is still of the name of WATT in our city who possesses a good mathematical head. Our officiousness, Gentlemen, please forgive, our style excuse; and be persuaded, that to see this fabric that is to be styled Watt's Monument a stylish one, is the earnest desire of

Your obedient servant,
L. M'L.

CURE FOR THE ITCH.

GENTLEMEN, — I observe in No. LXXI., Vol. III., of your Magazine, an article which smells strongly of an apothecary's puff, a cure for the itch, by L. M'L., Coll, "cured in 9 or 10 days." Why not apply the old highland nostrum —butter and brimstone? It would, I have no doubt, done the cure in as short a time, which is far short of what other nostrums promise, "to be cured by one application." L. M'L.'s ten *talons* may be of infinite use to him in flaying alive, but his *talents* for writing, I do not much admire. I must, however, give him great credit for his philanthropy; his receipt may do some good in his own neighbourhood, but we have no use for it in this part of the country.

I am, yours, &c.
A MECHANIC.
Glasgow, 9th May, 1825.

QUERIES.

1. If a ring be suspended in a vertical plane by a thread from a fixed point, and the thread twisted with considerable rapidity, at first the ring will revolve around its vertical diameter; as the velocity increases, the revolution will vacillate, till, by increasing the velocity, it will revolve in its own plane. *Query:* the cause?—The experiment, which is common, and very instructive, may be exhibited many different ways.

2. In the common pulley, is the mechanical advantage, *practically* considered, due mostly to the shears? And how much?

3. In the operation of the saw, what is the advantage gained by the teeth diverging alternately?

GENTLEMEN,—Will any of your numerous Correspondents inform me, through the medium of your Magazine, the most accurate method of ascertaining the length of the radius bar of a parallel motion, when the length does, or does not, exceed the parallel?

Also, what is the necessity of having an over-hinge at the crank end of a steam engine walking beam?

A YOUNG MECHANIC.
Broomielaw, 9th May, 1825.

GENTLEMEN,—It would be doing the public a great service, and to me a most material saving, if any of your Correspondents could give a remedy for preventing mites in cheese.

A CHEESEMONGER.

USEFUL RECEIPTS.

To make the Lead Tree.—Procure a phial or decanter, and fill it with spring water, to which add a small quantity of sugar of lead, (about an ounce of lead to a quart of water,) then, to a piece of zinc, fasten a wire crooked in the form of a still worm; fasten the zinc in such a manner to a cork that the wire hangs downwards; immerse this into the fluid, and in a few hours, the tree will begin to grow, and produce a most beautiful effect.

Test of perfect Vaccination.—When a person has been vaccinated on one arm, the surgeon should vaccinate the other arm with matter taken from the first. If the first vaccination has been perfect, the pistules on both arms will grow to a head at precisely the same time; and if this does not take place, the system has not been properly affected, and the vaccination ought to be repeated. This simple and easy test, first brought into notice by Dr. Bryce of Edinburgh, ought never to be neglected.

Method of cleaning Gold Trinkets, and of preserving Engraved Copperplates.—Boil the trinkets in water of ammonia, which dissolves the metallic copper of the alloy to a certain depth, so that after the operation, the metal is in fact gilded, nothing but pure gold being visible. In this process, the waste of gold, which takes place by the application of neutral salt to disengage nitric acid, the usual method of cleaning trinkets is avoided. Hitherto, chemists have neglected to observe that metallic copper is soluble in ammonia. Dr. M'Culloch has shown that the solution takes place rapidly at a heat sufficient to boil the water of ammonia. He says, copperplates are apt to be injured by lying by, a coat of oxide forms on the surface, which is rubbed off by the hand of the workman on the first inking, when the plate is again used; and by the reformation of the oxide, and of its being again removed, the fine lines of the plate are soon injured, and ultimately obliterated. To prevent this, he recommends the application of common spirit varnish to the surface, when the plate is laid by; it is easily applied, and can *be removed* by spirit of wine.

To make Old Port Wine out of New.—It is useful to be aware that port wine may speedily be rendered aged by heat; and in this case it deposits its coat and assumes the marks of old wine to the eye, as well as to the palate. One year will thus do as much for port as five or six in the ordinary mode of keeping, but the period of its entire duration will be comparatively shorter. The effects of heat in maturing port, have hitherto been a secret in the hands of a few. In America, it is a well known practice to boil Madeira wine, or to heat it to the boiling temperature, and the effect is to impart to harsh new wine, the qualities of that which is ripe and perfect in flavour. This practice is applicable to port. If newly bottled wine be exposed to the sun, it shortly begins to deposit its colouring matter, and improves in flavour; and even the rawest wine of this kind may, by heating it in hot water, be caused in the course of a day to assume the quality which it would have had after many years' keeping. It is so far from injurious, as might be imagined, that it is a valuable secret, and we believe one that is but little known, even to those whose interest it is to give the complexion of old wine to new, and who generally effect this in a fraudulent manner, by putting it into foul crusted bottles.

THEATRE DU PETITE LAZARI.

We are not in the habit of noticing public exhibitions, but the Mechanical Exhibition at present in the Assembly Rooms, has pleased us so very much, and besides lies so much in our way, that we cannot avoid speaking of it, and recommending to our friends to pay it a visit. We never saw any thing of the kind more admirable. The motions and actions of the puppets are perfectly natural; so much so, indeed, that one seems almost to have got into Liliput. We can hardly believe the figures, diminutive as they are, not to be alive. The scenery too, is deserving of particular notice and commendation. The perspective is admirably preserved, and our young friends desirous of attaining a knowledge of this art, will learn more in a few visits to the Assembly Rooms than they would do by studying treatises for a twelvemonth.

NOTICES TO CORRESPONDENTS.

Mr. Buchanan's Machine in our next. A. B., Dollar, and K. have been received. We must still differ with Hydraulicus, and express more than a doubt as to the possibility of a series of syphons working in the manner he mentions: however, when he sent us the first article, he ought to have mentioned that he had discovered that the full value of the syphon had never hitherto been understood; we would have noticed his article rather differently certainly, but we cannot insert it without making ourselves more fully aware of the possibility of what he says. He must, however, be now aware, we should think, that he mistook the meaning of the question by "A Coal Hewer."

Communications from Intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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> "Britain, fair daughter of the seas,
> Is born for trade! to plough her field—the wave,
> And reap the growth of every coast."

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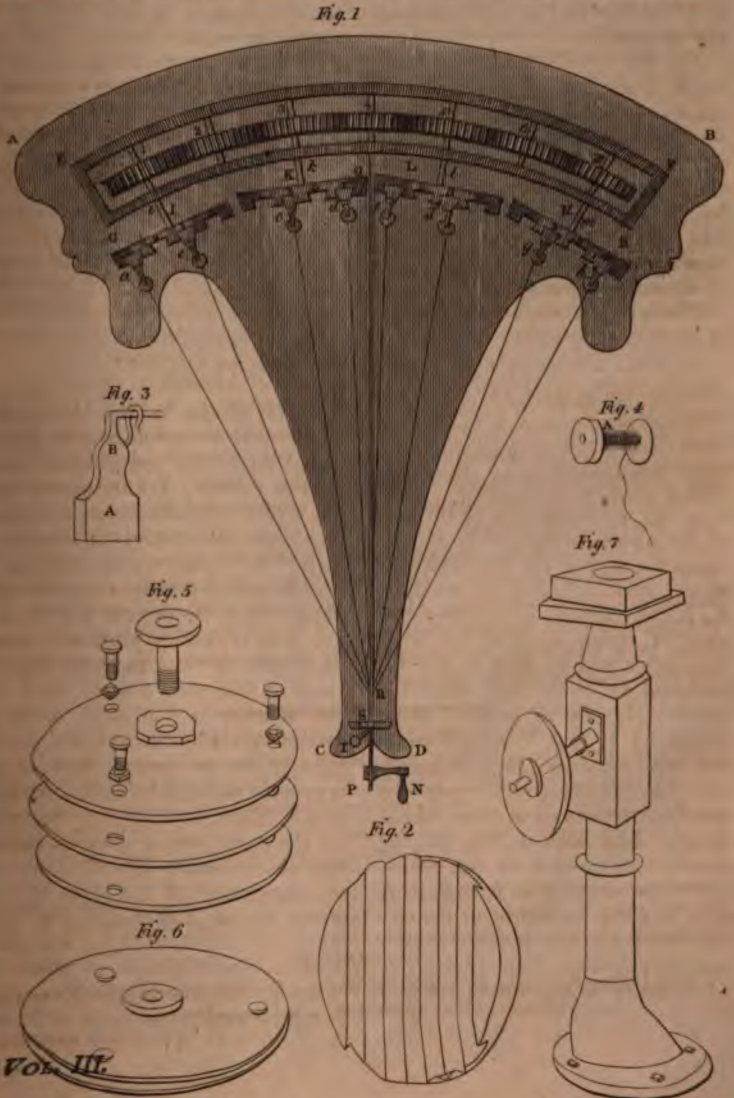
BUCHANAN'S MACHINE FOR WEAVING NET-WORK.
BARLOW'S IMPROVEMENT ON THE MARINER'S COMPASS.



VOL. III.

Swan Sc.

BUCHANAN'S MACHINE FOR WEAVING NET-WORK.

GENTLEMEN,—Through the medium of your Magazine, I beg leave to present the public with the description of a newly-invented machine, the objects of which are to weave, expeditiously and without knots, any kind of net-work, and to allow the holes or meshes of the net-work to be enlarged or diminished, according to the option of the operator.

We are indebted to Mr. Alexander Buchanan of Paisley, with whose permission I make the invention public, for contriving the present, which adds another instance to the number of proofs that he has already given of his inventive genius, and ardent desire to improve the arts and manufactures of his native country.

The machine in question consists of the following parts:

A, B, C, D, fig. 1, represents a wooden stand, upon which an iron frame, E, F, G, H, is supported at each corner. In this frame there are seven wheels, 1, 2, 3, 4, 5, 6, 7, that pitch into each other. *i*, *k*, *l*, *m*, are continuations of the axis of the wheels numbered 1, 3, 5, 7. Upon the ends of the axis thus continued, circular pieces of wood, I, K, L, M, are fixed, a perspective view of which is given at fig. 2. The other wheels, 2, 4, 6, are introduced in order that when the machine is put in motion, those numbered 1, 3, 5, 7, may turn in the same direction, as it is necessary that the parts of the machine attached to the axis of these should do so. Into each of the circular woods, four grooves are cut, which allow the shuttles *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, to slide out and in at the circumferences of the circular woods, but prevent them from coming out when drawn in a direction towards *R*.

The shuttles, one of which is represented at fig. 3, consist of three parts. A, (fig. 3,) is that part which slides into the grooves, B, the projecting part, and C, that which holds the pirn or bobbin. The use of the grooves is to allow the shuttles to be moved from one circular wood to another in crossing the threads, to form meshes of the net-work, and to afford an easy method of attaching them to the circular woods after that they have been thus moved. In fig. 1, the circular woods are represented as turned half round, to show the grooves and shuttles in them. The grooves, in this case, are perpendicular to the wooden stand: it must be observed, however, that they lye horizontally when the shuttles are moved from one circular wood to another. This is necessary both for weaving the net-work properly, and for moving the shuttles with greater facility.

Fig. 4, represents one of the pirns or bobbins. One end, A, is considerably thicker than the other, and has a groove in it which, when the pirn is put on C, (fig. 3,) admits a spring D. This spring acts as a counterpart to a weight that is suspended from the ends of the threvels, one of which proceeds from each pirn to keep them from entangling with each other. Each of the shuttles is furnished with a spring, all of which must individually be so strong, that their aggregate strength will prevent the weight from drawing the threads off the pirns, and at the same time sufficiently weak to allow the threads to come easily off the pirns when drawn by the operator. Into the centre wheel, 4, (fig. 1,) another pitches, having the same number of teeth; this wheel, which cannot be represented in the figure, is fixed

nd of the iron rod O, P,
e other end of it a handle,
tened. By this handle the
is put in motion. The
O, P, turns in two gudg-
e of which is concealed by
frame, the other is repre-
S.

now given a description
Buchanan's simple and in-
machine; and if I have
ficiently explicit in doing
ethod of using it will easi-
mprehended. The pirns
een previously filled with
r with any substance of
net-work is to be wrought,
d on the shuttles. The
the threads are then col-
d tied together, after which
put through a ring that is
on the top of the gudgeon
,) and also through a hole
sole or wooden stand; a
then suspended from the
the use of which, as was
mentioned, is to prevent
n entangling. It must be
however, that before the
is put in motion, the shut-
py the proper grooves.
icular is illustrated in fig.
the shuttles *a*, *b*, in the
ood I, occupy the 2d and
es; those of K, H, *c*, *d*,
he 2d and 4th; those of
st and 3d; and those of
e 2d and 4th. The ope-
mences weaving the net-
turning round the handle
he size of the meshes of
ork, he enlarges or di-
at pleasure, by turning
e a greater or lesser num-
mes. By turning round
e, the wheels in the iron
d the circular pieces of
are fixed to the axis of
ose wheels, are made to
but when those pieces of
revolving, the threads
ceed from *the shuttles of*
each are twining round each other. The twist made by this movement is made tight by the operator, who puts a finger of his left hand between each pair of threads, and with his right hand inserts, horizontally, the clearer, which is a thin piece of wood, shaped like a paper-cutter, between each pair of threads, drawing both his hand and clearer towards R, at which place it is prevented from going any farther by a knot. He then removes his hand, leaving the clearer to keep the twist tight, and crosses the threads to form the meshes. This is effected by moving the shuttles from one circular wood to another.

This operation resembles, and effects exactly, the same object as the crossing of the pins in working lace. The shuttles of the middle circular woods are charged first. Those of the circular wood R, occupying the second and fourth grooves, are moved into the second and fourth of the circular wood L, while those of L are shifted into the first and third grooves of K. This movement forms half a mesh. The operator then turns round the handle the same number of times as formerly, to twist the other sides of the mesh that is already half formed, and also to twist the sides of other two meshes. This being done, and the twist made tight by the method just explained, the threads are again crossed, which is done as formerly by moving the shuttles from one circular wood to another. In the former instance, only the threads of the middle circular woods were made to cross each other; in this, however, the whole must be crossed, and, consequently, all the shuttles will require to be moved. Those of the circular wood R, are moved into I; those of I, into K; and those of L are moved into M; while those of M are moved into L.

By the first moving of the shuttles, those of the circular wood K were shifted into the corresponding grooves of L; and those of L were moved into the corresponding ones of K; so that by shifting them in the present instance, those that originally occupied the circular wood L, are moved into I; and those that originally occupied K are moved into M. This operation completes other two meshes. Thus, by twisting and crossing the threads, any quantity of net-work may be wove; the operator drawing more thread off the pirns as the former quantity is used.

In describing the method of using Mr. Buchanan's machine, I have called the substance with which the net-work is wrought, *thread*. It is not to be understood, however, that this is the only substance which can be employed. It is a property of the machine that any kind of yarn or twine may be warped with it, so that by using fine yarn, and giving the handle a few turns, a texture may be wrought equally as fine as lace; and from the simplicity with which it may be wrought, I would strongly recommend the machine to the junior branches of families, who will find the using it to be an agreeable and profitable amusement. The present machine, I have already mentioned, is the contrivance of Mr. Alexander Buchanan of Paisley. This gentleman has already appeared before the public as the inventor of the method for manufacturing sheniel cloth, along with several other contrivances with which he has occasionally favoured his townsmen.—If, Gentlemen, the successful application of an inventive genius, or the laudable and praise-worthy exertions of an ardent desire to improve those arts and manufactures which enable Britain to rank high in the catalogue of commercial nations, deserve respect and esteem, the private labours of Mr. Buchanan entitle him, in no small degree, to receive those honours. A.

MR. BARLOW'S IMPROVEMENT ON THE MARINER'S COMPASS EXPLAINED.

We have already, in No. LXV. given an account of this improvement; but as some of our friends seemed to think it was not sufficiently explicit, we this week present them with an engraving of the Instrument, and a farther account of it, abridged from the Edinburgh Philosophical Journal. We do not think we require to make any apology for this, because in a maritime country like ours, which, though so greatly indebted to its commerce for its prosperity, has not yet half profited by its admirable situation, the smallest details on maritime subjects should be interesting to the people. We shall not, therefore, we trust, *be censured* for giving a place in our pages to an account of a discovery, which must have a considerable influence both on our prosperity and our power. It has been said, also, "that if any vessel be in future allowed to go to sea, especially in high latitudes, without the precautions pointed out by Mr. Barlow, the loss both of property and lives, in the event of shipwreck, may, in most cases, be fairly attributable to the owners." But those owners only can be held responsible who are acquainted with Mr. Barlow's discovery; and we may do something towards creating that responsibility. Mothers who have children, wives who have husbands, children who have fathers, and all who have relatives and friends at sea, must be interested in whatever contributes to their safety. Sailors are so habituated to danger, that they are proverbially careless, and even think it unmanly to take precautions. Those to whom they are dear must, therefore, do this for them, and enforce on them the necessity of adopting a landsman's discovery; because, not being so bold as they are, he has sought out the means of avoiding danger. That they have allowed him to make this discovery is, in fact, a proof of their carelessness. For 600 years have they made use of the compass; day after day have they found its indications wrong, and been obliged to imagine strange currents in the ocean, or suppose an up-hill and down-hill at sea, to account for the ship's running ashore, or reaching spots from which, judging by their compass, they ought to have been far away. Notwithstanding frequent and enormous errors of this kind, causing a great loss of ships and valuable lives, so careless or so confiding have they been through all these 600 years, that, as far as we know, no one of them ever seems to have thought their compass was sometimes a faithless guide. In 1794, Mr. Downie, master of His Majesty's ship Glory, was the first to remark, that the "quantity of iron in ships had an effect in attracting the needle." Capt. Flinders traced its connection with the dip of the needle; but the matter was again forgotten, till Mr. Bain, another master of the navy, published, a few years ago, his valuable "Treatise on the Variations of the Compass." This fixed attention; and Captains Parry and Ross being directed by the Admiralty to make observations on the subject, during the voyage to the North Pole, it was found that the *compasses were on* some occasions, upwards of 50°, or more than the eighth of a circle wrong. This effect was certainly not so great formerly as at present, owing to the greater quantity of iron now used in constructing and ballasting our ships. The great pitch, however, to which it has now arrived, called for a prompt and efficacious remedy, or there could be no security for sailors: Mr. Barlow set himself to this task and succeeded. We shall not follow this gentleman through his ingenious experiments and his mathematical demonstrations, but endeavour to give our readers a plain account of the cause of the incorrectness of the common compasses, and of his remedy.

It has been long known, that when a magnetized needle is freely suspended, it only preserves itself in a horizontal position in a small zone near the terrestrial equator. To the south of this, the south end of the needle dips or inclines to the horizon; and to the north, the north end dips or inclines. This is owing to the magnetic attraction of the earth. It has also been long known, that the *upper* ends of all iron bodies attract the north end of such a needle in northern, and the other end in southern, latitudes; and the lower ends of all iron bodies have an opposite effect. It is *now* known too, from experience, that when the ship lies with her head and stern north and south, or in a line with the magnetic meridian, that these two attractions are either coincident or directly opposite, and have no effect on the lateral direction of the needle; but when the ship's head is turned towards the east or the west, the needle, owing to the effect of these two opposite forces, namely, the magnetic attraction of the earth and the attractions of the ends of the iron bodies in the ship, no longer points north and south, and its variation will depend on the resulting action of both the magnetic attraction of the earth, and the iron of the ship. This variation, when not taken into account, as it never was till now, makes the course of the ship, as shown by the compass, different from her real course. It depends, too, on so many circumstances, such as difference of place, difference of direction of the ship's head, and the quantity and position of the iron in her frame, as almost to bid defiance to calculation. The first additional fact Mr. Barlow seems to have ascertained was, that the points in all bodies of iron, situated between their upper and lower ends, which had no effect on the needle, were all in the same plane, and this plane formed with the horizon an angle equal to the complement of the dip descending from the north towards the south. The needle of the mariner's compass is suspended horizontally, or is not allowed to dip; and Mr. Barlow found that the same fact was true of such needles, as well as of dipping needles. It was before known, that a large mass of iron attracted more powerfully than a smaller mass, and that the power varied inversely as the cube of the distance; Mr. Barlow has, however, shown, which fact is very extraordinary, that this power resides wholly in the surface of the iron, and is the same in a hollow shell, the substance of which is not one-twentieth of an inch thick, as in a solid ball of the same circumference.

These discoveries were applied as follows:—It is plain, that in such a mass of iron as forms part of a ship, by far the greater part is neutralized by opposite actions, and that all the effect may be referred to one single point of the vessel; and this point as regards the ship, *will be the same* in all parts of the world. But as the surface of iron only possesses magnetic power, it must be easy to procure a plate of iron of inconsiderable weight, which, when placed near the compass, shall counter balance the iron of the ship. The first thing to be done is to ascertain the local attraction of each vessel. The ship being so moored as to admit of her head being directed to each point of the compass successively, and there steadied, the bearings of some distant object are to be taken round the whole circle. These bearings will vary from each other according to the attractive power of the vessel; and it will be found that two of them, taken while the ship's head was directed to opposite points of the compass, nearly agree. The mean of these two is considered the true bearing; and by them also the line of no attraction in the vessel, which is generally straight, fore and aft, is known. By then comparing the true bearing with the bearing found at every point of the compass, the local attraction at every one is found. Hitherto it has been a matter of experiment on shore, to determine the situation in which a plate of iron ought to be placed, as to the compass, in every ship, in order to correct the local attraction. Tables will ultimately be calculated, however, so as to make this unnecessary. The plate may be placed either before or abaft the compass; in the former case doubling the effect of the attraction, in the latter neutralizing it. The former is better for southern voyages, the latter for high northern latitudes. The plates vary from 12 to 16 inches in diameter, and, in fact, the instrument has hitherto been made of two plates screwed together. They have a hole in the centre, through which is passed a brass socket with a broad head, having an exterior screw, with which the two plates, and an interposed piece of wood of the same size, are strongly screwed together, the board being intended to increase the thickness without adding to the weight. The several parts of the plates are represented in figs. 5 and 6, and fig. 7 shows the brass pin, socket, and pedestal, and the whole combined, as in action on shipboard. We have only to add, that this apparatus has been tried in several of His Majesty's ships with the greatest success. In one instance, reported by Lieutenant Mudge, the situation of the ship, after a run of 183 miles, as pointed out by the common compass, differed 19 miles in latitude, and 32 in longitude, from her true situation. On trying the compass by Mr. Barlow's corrected one, it was found to be wrong 7°; and when this correction was applied, the situation of the ship, as indicated by the cómpass, differed from her true situation only two miles of latitude, and four of longitude. We are quite sure that our readers, whether they are animated by patriotism, or soothed by the more gentle feelings of humanity, will forgive us for occupying so large a portion of our space with the description of a simple instrument, which, we conceive, will be to sailors what Sir Humphrey Davy's safety-lamp is to miners. Before they possessed these, they could descend into the mine or sail over the ocean; but now alone can they do either, with an instrument in their hand that warns them when danger is near, and shows them how to avoid it.

ON DRAINING OLD WASTES IN COAL MINES.

Gentlemen,—I see that No. LXXIII. contains two communications on the draining of coal wastes. Both writers seem to have some practical knowledge of the business, but have in some measure mistaken the plan I submitted in No. LXX. I cannot imagine what induced S. S. to say that I proceeded on the ground that the workings were on a horizontal plane, or to suppose that would make the smallest difference in practice. Every person who has looked at a quarry or sand-pit, or given the smallest attention to geological accounts, know that the strata in general make more or less of an angle with the horizon. The coal in the neighbourhood of Dunfermline has the most remarkable dip of any I have seen described. If I recollect well, the drawings appear by the eye to give about 30 or 35 degrees. But be the dip great or small, there *can be no difference.* Every one knows that any working under ground must be kept clear of water; and surely water standing so high above such workings, as to threaten an inundation, may be carried off by the same channel if conducted to it. I hope these remarks will remove the misapprehension of S. S.

It is concluded by A. K. J., that to act according to my plan, the boundary of the waste must be exactly ascertained. This is no more necessary than by any other mode. When danger is apprehended the trial must be made; and I proposed making it at the surface of the water in the waste, to avert the danger of the water bursting in. The only difficulty stated is that of making a horizontal bore at the surface of the water. The term horizontal here means no more than lateral; it may follow the dip or rise; it may begin anywhere, provided it end about the surface of the water; or the nearer it, the less will be the danger. The bore must evidently be ultimately widened to a small tunnel, before a syphon can be applied; perhaps it might be more easily made without boring at all, but these are points that may best be determined by the practical miner.

I am, yours, &c.

G. M.

Glasgow, 18th May, 1825.

MUSICAL THRUSH OF BRAZIL.

"We first observe in these woods the notes of a greyish-brown bird, probably a thrush, which frequents the bushes and ground in damp low woods, and sings with numerous repetitions through the musical scale, from H^1 to A^2 (of the German scale) so regularly, that not a single note is wanting. It commonly sings each note four or five times over, and then proceeds imperceptibly to the following quarter tone. It is usual to deny to the songsters of the American forests all melody and expression, and to allow them no pre-eminence but splendour of plumage. But if, in general, the pretty natives of the torrid zone are more distinguished by the beauty of their colours than by fulness and power of note, and seem inferior to our nightingale in clearness and melodiousness of tone, yet this little bird, among others, is a proof that they are at least not destitute of the principles of melody. How far the musical improvement of man has already had an influence on the notes of birds, remains an interesting subject for physiological investigation. It is at least inconceivable, that when the almost inarticulate tones of a degenerate race of men no longer resounds in the woods of Brazil, many of the feathered songsters will also produce more refined melodies."—*Spix' and Martius' Travels in Brazil.*

ON THE CRANK.

Gentlemen,—I had not an opportunity of reading G. M.'s communication, (page 141, Vol. III.) before I sent you that in page 167; otherwise it would have been unnecessary to have said any more about the crank. He has pointed out the source of error arising from overlooking the well known principle, that mechanical power is measured by the product of the force into the velocity. It is known by the principle of virtual velocities, that when two forces or weights are in equilibrium, if they be put in motion their velocities are inversely as the weights, or $W' : W = V : V'$ and $W' V' = W V$, and hence, in this case, their momenta are equal. From this it appears, that if a weight W be uniformly diffused over the semicircumference of a wheel, it will be balanced by a weight $W' = W$ at the centre of gravity of the opposite semicircumference, and if they be then put in motion, the velocity of W' or V' will be only about $\frac{2}{3}$ of that of W or $\frac{2}{3}$ V. But then the weight W is diminished in its force to about $\frac{2}{3}$ W, and hence their momenta are equal. This way of measuring mechanical power is just the same in principle with the usual method by the weight raised to a certain height in a given time. For the space through which a weight W is raised in a given time is just its velocity, and the mechanical effect or momentum is W V. As an example of this principle, the strength of a horse will raise 32,000 lb. through 1 foot in 1 minute; and that of a man is often reckoned to be about the $\frac{1}{5}$ of this, or be able to raise 6000 lbs. 1 foot in 1 minute. In general, a weight W being made to descend through a vertical height $= H$, should raise a weight W' through a height H', such, that $W : W' = H' : H$ or $W H = W' H'$.

A state of equilibrium in the case of any of the mechanical powers, afford familiar illustrations of the same principle. For if any of them, when in this state, be put in motion, the power is to the weight, as the velocity of the latter to that of the former; and also, the vertical height through which they pass in the same time are inversely as the power and weight.

Or, if W and W' be respectively the power and weight, V and V', their velocities, and H and H', the heights through which they pass in the same time,

$$\text{then } W : W' = V' : V,$$
$$\text{and } W : W' = H' : H, \text{ or}$$
$$W V = W' V' \text{ and } W H = W' H'.$$

I am, yours, &c.

A. B.

Dollar, 17th May, 1825.

ESSAYS ON BLEACHING,

By James Rennie, A. M. Lecturer on Philosophy, &c. &c., London.

No. I.—HISTORY OF THE ART.

SECTION II.

The art of bleaching was known to our ancestors in Britain as early at least as the first century, as we are informed by Pliny, (Hist. Nat. lib. XXX. c. 50.) who tells us, "that the flax, after being spun into yarn, was pounded several times in a stone mortar with water; and when it was woven into cloth, it was beaten again upon a smooth stone with broad headed cudgels; and the more frequently this process was repeated, the whiter and softer the cloth became." A more accurate description could not be given of a process which every Scotsman, who has lived in the country, must have seen employed by the peasants of the present day. This simple process, however, is aided by boiling with soap or kelp, and by crofting; but even in Pliny's time, they had recourse to vegetable alkalies, as he tells us, in the following book, that the process was much facilitated by *macerating in the water* the roots of a kind of wild poppy, which was much sought after for this purpose, and made the linen look "wonderfully pure and white." Might not this wild poppy be the cuckoo pint, (*Arum maculatum*, Lin.) which even in modern times has been used in bleaching in France and other parts of Europe? (Parkes' Chem. Ess. IV.) We are told by Lewis, (Newman's Works, II. p. 226.) that the juices of this plant have the property of destroying the resinous colouring matter of vegetables; but I think the effect might be better accounted for by a peculiarity in this plant, first observed by Lamarck and Sennebier, namely, that it contains a greater quantity of sensible heat than any other plant whose temperature has been examined. (Smith's Intr. to Bot.)[1]

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[1] This is not peculiar to the Arum maculatum; for M. Hubert found, that the spadix of the Arum cordifolum raised the thermometer from 19° to 44°; (

The use of plants in bleaching is not peculiar to Europe. The Indians in North America, as M. De Lery tells us, make a detergent water from certain fruits, with which they wash and bleach their cotton beds and garments. (Voyage de J. De Lery, p. 276.) It is likely that he here alludes to the fruit of the Myrica Cerifera, of the mode of making soap from which, M. Cadet gives an excellent account in the Annales de Chimie. Dec. 131.

We need not wonder that attention would be paid to this art among the Greeks and Romans, when we are aware of the delicate fineness to which they brought their linen cloth, and the value at which certain sorts were estimated. We are informed by Pliny, that a kind of lawn, made from the flax denominated Byssus, which grew in Achaia, was so much esteemed in the first century as an ornamental dress, that it was sold for its weight in gold. We are at no loss from this to see, why its use was considered, by some austere Romans, as a mark of unpardonable luxury and effeminacy, (Hist. Nat. lib. II. c. 1.); and the same author tells us, that the threads of the Retovine linen are evener, if evener may be, than that of a spider: he himself had seen so fine and small a thread of Cumes flax, that a whole net knit of it would pass through the ring of a man's finger; and he had seen also some so fine, that one man could easily carry as much yarn as would go round and compass a whole forest. But the *finest cloth*, he says, (lib. XII. c. 10.), which was made in his time, was manufactured from the cotton which grew in India and Persia. There was a great difference, however, in the whiteness of the several sorts of linen, either from the mode of bleaching, or from the nature of the materials. The Faventine, for example, was always whiter than the Allian, which was commonly brown before it was bleached. Pliny likewise gives an account of the earths and plants employed by the Romans in bleaching and washing; but it is likely that these methods were soon improved after his time, as we know that the manufactory of soap, contrary to the assertion of Beckman, was carried on to some extent in Italy; and it is not long since a complete manufactory for boiling soap was discovered in the subterranean Ruins of Pompeii. This soap had been made by combining alkalis with an oil. (See Starke's Letters from Italy.) Immediately subsequent to the time of Pliny, the Romans indulged in what their fathers had considered to be effeminate; and white cloaks of linen were almost universally worn. (Beckman's History of Inventions, III. p. 270.) May we not then consider it rather as a poetical flourish than a correct description, which we find in Valerius Flaccus, of the dress of a warrior who was slain at Colchis during the Argonautic expedition; especially when we consider, that this author lived near the time of Pliny, when linen was still of inestimable value? The passage runs thus:

Cadit —— —— Taulantis alumnus ——
Tenina non illum *candentis carbasa lini,*
Non auro depicta chlamys, non flava galeri
Cæsaris, pictoque juvant subtemine bracal.
Val. Flaccus, VI. 221.

We cannot, however, distrust an eye-witness:

'Επορευθησαν δια Χαλυβων — εἰχον δε θωρακας λινους μὲχρι του ἠτρου.
Xenoph. Anab. IV.

The preceding notices, it must be confessed, are scanty and imper-

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Edin. Rev. VI. 129.) and M. Bory de St. Vincent made a similar remark on the Arum esculentum. (Voyage dans L'Afrique.)

fect; but they are all which I have been able to collect from my limited acquaintance with antiquities. In the ages which succeeded those of which we have now been speaking, our information upon this, as upon almost every other topic, is altogether imperfect. It is probable that the art in question, remained nearly as it had been transmitted to the people of the middle ages from the ancients. This amounts nearly to a certainty, when the earliest of our modern processes are compared with what we know of antiquity. In Iceland, which, from its remoteness, we may suppose comes but accidentally acquainted with the improvements made in the other parts of Europe, they bleach with a ley made of ashes and urine. (Hist. de l'Islande, I. 266.)

The earliest account which has come to my knowledge of the mode of bleaching in modern times, is given in a book now become scarce, but a copy of which I was so fortunate as to procure from Stirling's Public Library; it is entitled, 'Select Essays on Commerce,' &c. (8vo. Lond. 1754.) The mode of bleaching there described, was practised in Holland and Flanders, and consisted in souring with milk or bran, in boiling with alkaline leys, and in exposing the goods for a whole summer to the sun and air. This book, however, must be comparatively modern with the processes it describes; for long before this, we find "*Holland* white as snow" mentioned in our old ballad poetry. There are indeed few of our oldest ballads and traditionary legends which do not mention shirts and other garments made of "Holland fine." The Dutch and Flemish process being unknown in the other parts of Europe, it began to be supposed that there was something *in the air or the water* of Holland which produced linen of so clear a white; and the adjacency of the sea was mentioned as one of the causes of this. All the bleaching grounds in Holland, indeed, were situated near the sea, as it had been found by experience that the sea air seemed to produce a fairer white than that farther inland. If the cause of this had been inquired into with any degree of philosophical acuteness, it might have led rapidly to the unexampled chemical improvements which have been lately made in the art of bleaching. But the period of which we speak, was only the dawn of the philosophical arts. Every process was conducted by blind precedent, without the slightest hint ever intruding itself *why* such things were done. But this dawn, faint as it was, soon brightened into all the splendours of noon-day; and if I am not misinformed, the world is indebted to Scotland for the first application of chemistry to the art of bleaching.

Two years after the publication of the Select Essays, Dr. Home, the Professor of Chemistry in the University of Edinburgh, published his inestimable Experiments on Bleaching, in which he proved that employing oil of vitriol (sulphuric acid) for souring linen goods was both more economical, more efficacious, and less liable to uncertainty than the Dutch mode of souring with milk or bran. Previous to Dr. Home's experiments, the art of bleaching was quite in its infancy in Britain. Even so late as 1752, British linens were sent to Haarlem to be bleached, at a considerable expense and much loss of time. The Dutch process is commonly supposed to have first been practised by the Scotch; but it was certainly first known to the Irish. The Scotch linens were usually sent over to Holland in March, and were not returned in a finished state till October following, when they were sent to the London market under the name of Scotch Hollands. On the authority of Patrick Milne, Esq. M. P., Mr. Parkes states, (Chem. Es. IV. p. 18,) that an Irishman who had learned something of bleaching, settled, in 1749, in the north of Scotland, and was entrusted with the linens to bleach which had formerly been sent to Holland. His first attempts, however, were unsuccessful, and after he had done his utmost, the goods had to be sent to Holland to be finished. But several years' inquiry and experience made him an excellent bleacher, and by assiduously practising the art, he soon realized an opulent fortune. At the same time the Scotch manufacturers were greatly benefited by having their goods sooner ready for the market, and their capital more quickly circulated. Dr. Home's improvements, which immediately followed this, gave our countrymen a decided superiority in this art, and the north of Scotland soon stood as high as Holland and Flanders had previously done.

In order to show the advantages of Dr. Home's improvements, it may not be out of place to give an account of the mode which was previously followed, a little more in detail. For this purpose, I shall select the process for bleaching linen yarn, which was very operose, and required four times the expense of cotton yarn; inasmuch as the colouring and resinous matter is in much greater quantity in the former. Most sorts of linen yarn, for example, will lose 27 per cent. of their original weight before they are thoroughly bleached, while cotton yarn will lose only 4½ or 5 per cent. by the same process. The following account is given by Parkes, of the mode of bleaching linen yarn about half a century ago. The brown yarn was first immersed in hot water for three or four days, or macerated in cold waste alkaline leys for about forty-eight hours, which, by producing a fermentation in the vegetable substance, or otherwise acting chemically upon the fibres, loosened the saliva of the spinner, or such foreign and heterogeneous matters, and rendered them easy to be removed by simple washing. The yarn was next boiled and steeped in alkaline ley, the apparatus being so contrived that the ley was poured over the goods, through which it percolated till it reached the bottom of the vessel, whence it was drawn off into a heated copper; and from this again it was pumped back over the goods, and so on alternately and uninterruptedly for many hours. The yarn was then well washed, and exposed on the grass for two or three weeks. It was now bucked again, washed, and crofted as before; and these processes were alternately continued four or five times, the strength of the ley being gradually reduced in each successive bucking. After the yarn had been bucked four or five times, it was immersed in soured milk, in which it lay two or three weeks, till the scum, formed by the matters disengaged by fermentation, began to crack and subside. The yarn was then taken out of this *first sour*, and well washed; and the processes of bucking, washing, crofting, and souring, were alternately repeated, till it was thought to be clean and of a good colour. For cleansing and finishing they employed soap, which renders the goods soft and delicate, and makes them handle better than when they are simply washed in pure water. Now, from this account it is evident, that the old mode of bleaching was extremely tedious, troublesome, and liable to great uncertainty of result. If goods were sent to the field in March, they were not ready for the market before September; and if at midsummer, they could only be half-bleached that year; because it was found, that crofting succeeded best in the spring, and when any were unfinished in autumn, they were laid aside till March following.

The improvements of Dr. Home, then, were of great importance in saving time; for, by making the sours of sulphuric acid instead of milk, the process of souring, which formerly took two or three weeks at each repetition, could be finished in as many hours. A great deal of trouble was also saved, for great quantities of milk being requisite, it could not easily be collected and carried from great distances to the manufactory, as would frequently be necessary. The expense, likewise, of sulphuric acid, was considerably less than that of milk, owing to the improved process which was about this period invented by the ingenious Dr. Roebuck, for the extensive manufacture of this acid.[1] They found that sours composed of it, acted with more certainty and effect; while they did not, in the least, injure the fabric of the cloth. A prejudice long subsisted, indeed, which is not even yet wholly removed, that the fabric is weakened by vitriol sours; but Dr. Home proved, in the most satisfactory manner, by repeated experiments, that it is altogether unfounded. He kept, for example, a piece of linen in a strong sour of vitriol during several months, and the fabric of the cloth remained as firm and strong as before it was immersed. (Page 88.) Even in the present improved state of chemical bleaching, this improvement of Dr. Home's is of importance, and is still used in conjunction with those which are much more powerful.

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[1] The first large leaden chamber for this purpose, were erected by him at Birmingham in 1746; and, in three years afterwards, he established extensive works on the same plan at Prestonpans, whence he supplied not only the bleachers and other manufacturers of Scotland and Ireland, but also those on the continent, who soon learned to prefer it to milk sours.—*Parkes.*

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EDINBURGH MECHANICS' SUBSCRIPTION LIBRARY.

Gentlemen,—From the interest you have taken in any thing connected with the working mechanics of Britain, and from the full account of the different institutions for mechanics you gave in your Supplementary Number, on Saturday last, I have taken the liberty of sending this to inform you of the establishment of a new institution for the benefit of the mechanics of Edinburgh.

Two or three persons had been students of the School of Arts, and while there duly appreciated and received the advantages of the library; but they no sooner left off their attendance on the lectures, than they lost all right to it also, and this, after having been used to it, was, you may believe, against their wishes. They therefore resolved to attempt establishing one at such a rate as would not be oppressive to any working mechanic; and having got a prospectus drawn out on the 4th of February, they afterwards got about twenty-five to subscribe their names as all approving of the proposals, and a meeting was held on the 3d of March, when it was resolved to institute a library, to be called "The Edinburgh Mechanics' Subscription Library," and a committee was appointed to draw out articles, and to take the necessary steps for the furtherance of the plan. We have now the satisfaction to say, that every thing has gone on most prosperously, and that the public here have come forward to encourage the Institution in the most handsome manner.

We have herewith sent you one of our bills, circulars, and a copy of our catalogue, which contains a number of donations from the individual members; and we have got a most munificent donation, above £50 worth, from Messrs. Archibald Constable & Co. Booksellers, and twenty-two volumes, on different subjects, from Mr. Adam Black, besides others, as you will see by the catalogue. The library was opened on Tuesday night last to the subscribers, who now amount to nearly 200; besides, we are daily getting new ones. Thus, in the space of two months, has a library been opened, with every prospect of success, which has been accomplished by operatives alone, without the aid of any patronage whatever, except the public support, which they were certainly entitled to. And be it farther known to their honour, that several masters and gentlemen, and amongst the rest, two of the directors of the School of Arts, have come forward and entered as members, merely to encourage what they consider so useful an Institution.

If you think proper you may take notice of the above in your own way in an early number of your useful Magazine; as it is the only one that the most of the Edinburgh mechanics read, it will be gratifying to, Yours, &c.

A Member of the Committee
of the E. M. S. L.

Edinburgh, 12th May, 1825.

[It is with great pleasure we have perused the account of this new Institution in Edinburgh, as we think it now supplies almost all that is wanting for the information and instruction of mechanics in that city. The library attached to the School of Arts was perfectly sufficient for them, so long as they could attend the lectures; but they could not do this always, and having once known the pleasure and the benefit of a library, how were they ever after to want it? The same cause will produce the same result elsewhere, we hope; and we anticipate that this plan of a library separate from the institution, for the use of those not attending it, will speedily be followed in other places. Where the smallness of the town gives little prospect of the erection of a separate library, those who have attended the lectures should be allowed to retain an interest in the library, even after they discontinue their attendance; but wherever it is possible, we would recommend the instituting of a library on the plan of the Edinburgh Mechanics' Subscription Library. We approve decidedly of the books not being restricted to works of science alone, and we rejoice to see in the catalogue of this new library, books in every department of literature. Messrs. Constable & Co. have presented the library with the Edinburgh Philosophical Journal and the Edinburgh Review, both from the commencement, and the Supplement to the Encyclopedia Britannica, works which of themselves almost form a library.]

LORD BYRON AND MECHANICS' INSTITUTIONS.

We have always given it as our opinion that the management of these institutions should be left almost entirely to the mechanics themselves, as being the only proper mode of giving them a permanent interest in their success, and of preserving them entirely for the purposes for which they were originally intended. It is pleasing to us to perceive that the first poet of the age held the same opinion. Major Parry, in his "Last Days of Lord Byron," says:·

"After my acquaintance with Lord Byron, he took a great interest in all that concerned the welfare of the working classes, and particularly of the artizan. 'I have lately read,' he said on one occasion, 'of an Institution recently established in London for the instruction of mechanics. I highly approve of this, and intend to subscribe £50 to it; but I shall accompany the order for the money with a letter giving my opinion on the subject. I am always apprehensive schemes of this description are intended to dupe the people; and unless all the offices in such an institution are filled with real practical mechanics, the working classes will soon find themselves deceived. If they permit any but mechanics to have the direction of their affairs, they will only become tools of others. The real working man will soon be ousted, and his more cunning pretended friends will take possession and reap all the benefits. It gives me pleasure to think what a mass of natural intellect this will call into action. If the plan succeed, and I firmly hope it may, the ancient aristocracy of England will be secure for ages to come. The most useful and numerous body of people in the nation will then judge for themselves, and when properly informed, will judge correctly.'"

LETTERS AND QUERIES.

ON CURRENTS.

Gentlemen,—Please to insert in your very useful Magazine, for the information of all concerned, the following remarks on the Current, whereby the bottle, as published in the 'Free Press' of 9th April, was brought from 56° 58′ North, and 24° 30′ West, to the But of Lewis, situated in 58° 28′ North, and 6° 30′ West. It is said in the paper alluded to, that the general opinion is, that the current on the West coast bears westerly; whereas the course of the bottle found, shows the direction to be quite the reverse. The bottle differed its latitude 1° 30′, and its longitude 18° 0′. Its course was 82° East, and distance 650 miles. The direct course from where the bottle was committed to the water, to where it was found, being 82° East, or 7¼ points nearly. The end in view for making this experiment, was to guard against mistaking the direction of currents, which too often proves fatal on coming in with the coast; and if it be so, that the general opinion is that this easterly current bears westerly, no wonder that accidents so frequently take place.

Say a ship on the coast, bound to the southward, and, it is believed, is connected with a westerly current, measures are taken to counteract it, by bearing more to the East. Now, in this case, the ship goes freely the way that ought to be avoided, and so is drawn by an easterly current towards an easterly coast, and is perhaps land-bound before the danger is known.

I think it would be desirable, and of great utility, to make more and frequent experiments of this nature.

U. S. C.

12th April, 1825.

The following is the article in the Free Press referred to:—

"Extract of a letter from Messrs. W. and R. Morrison, dated Stornoway, 17th ultimo (March.) On the 12th current, a card, of which the following is a copy, was picked up on the sands of Dell, near the But of Lewis. 'English Brig, Ardent, from Hamburgh for Newfoundland, Sept. 22d, 1824, latitude 56° 58′ north, longitude 24° 30′ west from Greenwich: whatever hands this may fall into, I would thank them to give it publicity, to ascertain, if possible, the direction of the prevailing currents in this part of the Atlantic.' The direction in which this bottle has drifted confirms the general opinion of a westerly current, which, with the heave of the sea from the same points, account for many fatal accidents which happen to our shipping crossing the Atlantic in the fall of the year, by running a-head of their reckoning."

MISCELLANIES.

JOHNSTONE MECHANICS' INSTITUTION.

Gentlemen,—We have been very long of entering into the spirit of founding a *Mechanics' Institute*, and it is much to be wondered at when we consider the number of operative mechanics that are employed in and about this place. I suppose, from a slight calculation made in my own mind, there cannot be fewer than from two to three hundred employed in making the various kinds of cotton and other machinery, steam engines, &c. in this village, which contains about five or six thousand inhabitants, besides a numerous class of those who walk in a higher sphere, most of whom are also mechanics.

I am now happy to say, however, that a Mechanics' Institution has been set on foot by a number of the mechanics themselves, who called a general meeting for that purpose; and having previously concerted regulations by which it was to be conducted, they were read to a numerous audience, and after several amendments and alterations, were agreed to and signed by upwards of fifty, who bound themselves to become members. It is expected that the list of members will speedily increase. May all success attend it.—I am, yours, &c. J. S.

Johnstone, 18th May, 1825.

DALKEITH MECHANICS' INSTITUTION.

We are happy to learn that a Mechanics' Institution has been opened in Dalkeith by Mr. John Deuchar, Lecturer on Chemistry from Edinburgh.

One of our Correspondents promises to report the success of the above Institution, as soon as possible.

PATENTS.

W. Halley, Holland-Street, Black-friars-Road, iron-founder and blowing-machine maker; for improvements in forges, and on bellows or apparatus to be used therewith or separate.—March 5, 1825.

R. Winch, Steward's-Buildings, Battersea-Fields, engineer; for improvements in rotatory pumps for raising water, &c.—March 5, 1825.

J. L. Bond, Newman-Street, Mary-la-bonne, architect, and J. Turner, Well-Street, Mary-la-bonne, builder; for improvements in the construction of windows, casements, folding sashes, and doors, by means of which the same are hung and hinged in a manner adapted more effectually to exclude rain and wind, and to afford a free circulation of air.—March 9, 1825.

NOTICES TO CORRESPONDENTS.

I. M'L., J. W., J. A., A. R., S., and A Constant Reader, have been received. The letter of A. B., Paisley, cannot be inserted unless we know something of the nature of the invention he mentions. If he sends us an account of the machine, with a drawing, we shall insert it; but we cannot insert any vague notice, such as that sent us. We agree with F. as to the subject of his notice, but he is aware that the author is at a distance: we were therefore deprived of the power of recommending any thing to himself, and we have a very great unwillingness to interfere with his Essay ourselves. J. S., Johnstone, seems to be quizzing in his plan for obtaining an "immense power."

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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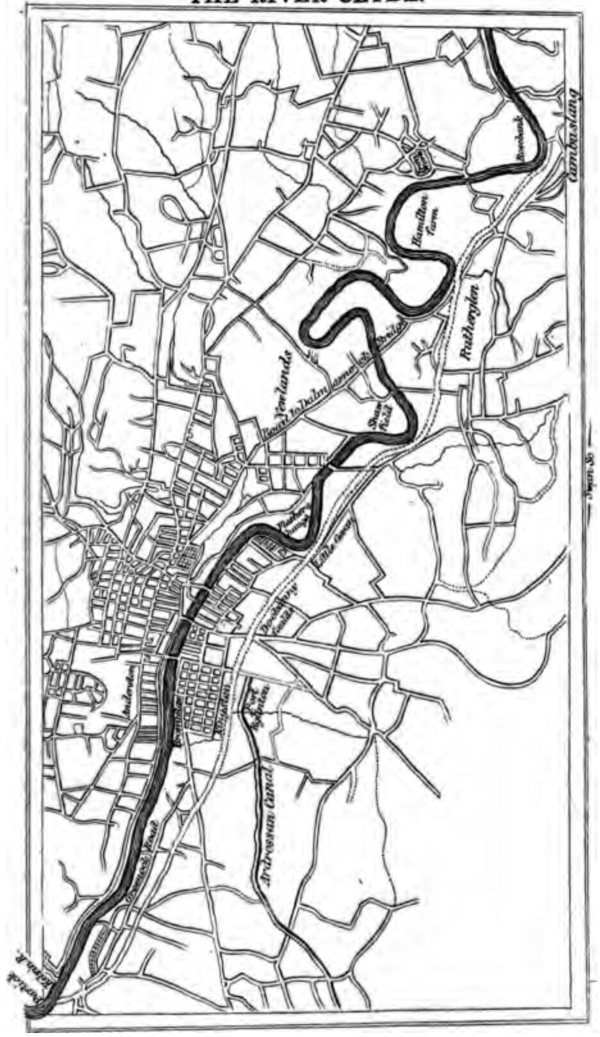
CURLL, PRINTER.

THE GLASGOW
MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

" Every accession which man gains to his knowledge, is also an accession to his power, and extends the limits of his empire over the world which he inhabits."

LXXVI. *Saturday, 4th June*, 1825. Price 3*d.*

MR. BOAZ'S PLAN FOR IMPROVING THE NAVIGATION OF THE RIVER CLYDE.



VOL. III.

ESSAY ON IMPROVING THE NAVIGATION OF CLYDE,

Read before the Glasgow Philosophical Society, on the 30th May, 1825.

By Mr. James Boaz, Accountant.

Mr. President,—Agreeably to my announcement to the Society on this day month, I now beg to lay before you the following, being my second Essay on improving the Navigation of the River Clyde.

On the 11th May, 1807, I read to you my first Essay on improving it, which was by means of a lateral cut through the projecting haugh-ground, or isthmus, on the south bank, a little above the point house, and having a wear or dam across the main bed of the River, due north of the isthmus, and so converting all above into a wet dock, communicating with the River below, by two pair of lock gates on the wear, and other two pair on the lateral cut. The said wear to be furnished with flood-gates and *floating* sluices, to allow a free scouring under-passage for the water at all times, particularly in high freshes; and part of it to be led off to drive machinery, and so yield a revenue.

The advantages to vessels, especially when loaded, of being kept always afloat, are well known; at low water, by sitting down on a hard uneven bottom, they often get strained, leaky, hogged, and sometimes break their backs altogether.

Since 1807, a great variety of other schemes have been suggested. The following is merely an improvement of my first one.

I now lay before you a sketch (see plate,) or plan of that part of the River upon which I think the operations should be made. It comprises, in windings of the stream, a length of more than 8 miles, although the distance in a direct line, like the string of a bow, is only $5\frac{1}{4}$ miles. This sketch I took from Mr. Forrest's excellent four sheet Map of Lanarkshire, lately published, and now also on the table. It is on a scale of $1\frac{7}{10}$ of an inch to an English mile. I have personally examined the ground and the River, and think them still more favourable for my scheme than even this sketch.

I propose that a new bed, or rather a left subsidiary branch, of the River, be cut for $5\frac{1}{4}$ miles, to be called "*The Straits of Clyde*," commencing at the acute angle at Cambuslang, 3 miles above Glasgow, and taking an almost direct W. N. W. course, till it entered the old bed opposite Partick, 2 miles below the city. This new branch could very easily be excavated, the whole intermediate ground being nearly level alluvia. Leaving Cambuslang, it would pass north of Rutherglen, through the lands of Shawfield, Little Govan, and Dockeny Fauld, (the latter, City property,) north also of Port-Eglinton, (with which it might communicate by lockage,) then past Kingston, along the south side of the Greenock Road, till it ran directly into the old bed, just where Kelvin enters the River on the other side. The lower end of the Straits to have two pair of lock-gates, to keep the surface always at the height of high water, and alike deep all the way up to Cambuslang. There might be one or more intermediate navigable cuts, communicating between the Straits and the old bed, particularly one crossing to the Broomielaw, and another to Bridgeton, and to various basons or wharfs which it might be an object to have; the whole furnished with draw or swing bridges where necessary.

At Cambuslang, have a set of gates on each branch of the fork, so that either of the beds could be laid dry if required. This would be very advantageous for the lower parts of the City, and prevent them from being flooded; as in very high freshes, half of the water might be allowed to pass by the new cut, and in summer occasionally even the whole: Indeed the River could in this way be managed just *at pleasure;* and there being but little declivity from Cambuslang to Partick, no mills are between them to be injured. The tide is seldom discernible above Dalmarnock ford.

I propose that the Straits of Clyde should be 33⅓ feet wide, and 15 deep, with a road on each side of same width, making 100 feet in all; besides which, I would have 100 feet more on each side, purchased to sell or feu off for wood-yards, slate-yards, wet, dry, and graving docks, wharfs, granaries, warehouses, and public works requiring coal, water and water carriage, and for various other purposes. Then, just above where Kelvin enters Clyde, I would have a wear thrown across the latter, furnished with gates, sluices, &c. mentioned in my Essay of 1807, above alluded to, as you will see in your minute-book of that date.

The old bed *up to* the Broomielaw would be always accessible for vessels at high water, but at low water they would have to *lock up*, or they could lock up the Straits, and pass across by one of the intermediate cuts; the same in going *down from* the Broomielaw.

The advantages of these arrangements are manifold. Large loaded vessels might pass up or down the Straits, full sail, without being impeded by either the New, Old, Wooden, Rutherglen, or Dalmarnock Bridges. Traffic by water could be carried on at all the intermediate places; and communications by tract boats, steam boats, coaches, or rail roads, opened with Clyde Iron Works, Uddingston, Blantyre Works and Village, Bothwell, Hamilton, Kilbride, and indeed with all the other adjacent towns and villages, besides the immense coal fields contiguous. Another cut might be advantageously made farther up the country to communicate with the Straits at Cambuslang.

As to the expense, it is impossible, without a proper survey, to say what it would amount to. As an approximation, I have made the following rough calculations.

5½ miles, or say 10,000 yards long, by 100 broad = 1 million of square yards; or, in round numbers, 170 acres, at £100 each, would cost, ...	£17,000
N. B.—The whole of this outlay, and perhaps a great deal more, might perhaps be got back, by the sale of the two stripes of land, 100 feet wide on each side of the Straits, as above anticipated.	
Excavating 1,000,000 cubic yards, at 6d.	25,000
Allowance for building the dam or wear, gates, draw-bridges, wharfs, and for contingencies, ...	25,000
	£67,000

Suppose the whole price of the ground would be got back by the sale of the bank lands, the annual interest on the remaining £50,000 at 4 per cent., would be £2000, to cover which, a small tonnage duty might be levied; or the cut might be made on a much less scale, though I do not think a puny power-wasting trench, like the

Paisley or Union Canals, would be any saving in the end.

Were it possible to make a concern of the navigation of the Straits *separate* from the Clyde Navigation Trust, this idea might be a good speculation for a Joint Stock Company. The trustees, however, are in general very public-spirited, and it is probable, if they do not consider this scheme too expensive, that they may countenance some modification of it. There is no doubt that it would impart new features to the neighbourhood, open up, and facilitate communications with all the country south-east of the City, so far as the proposed branch would reach, and greatly increase the value of the mineral property in that direction, as well as be a source of convenience to the inhabitants on and near the whole line. There would be a continuous sheet of water in both branches, ten miles long, navigable at all times of the tide, either for business or pleasure, on which there soon would plenty of watermen ply in small row-boats for hire, as in London, Venice, &c. The banks would also form an excellent *drive*—so much a desideratum to Glasgow.

When the Monkland Canal commenced, the prospects were not perhaps so flattering, and you all know the immense rise on the shares.

On some future evening I may perhaps go more into the detail of my views; in the mean time, I shall be glad to hear the opinions of yourself, and the other Gentlemen of the Society, on this subject.

JAMES BOAZ.

NICHOLSON'S OPERATIVE MECHANIC.*

THIS work is one which must be of very great importance, both to the engineer and the mechanic; and which is well calculated for the instruction of those who may be desirous of attaining a general knowledge of the principles of mechanics —of their application in machinery —and of the principal machines at present used in the arts and manufactures of our country. Many works have been written on mechanics and machinery, but we have seen none on the same plan with this one, or destined to be so very generally useful.

The most elaborate pieces of mechanism, however incomprehensible they may appear to the uninitiated, or those unacquainted with machinery, are the result of the combination of a very few simple principles; and in order therefore to prepare the reader for what is afterwards to be detailed, Mr. Nicholson, after some necessary observations on the forces acting on matter, on friction, and the centre of gravity, has very fully elucidated the mechanical powers. He then proceeds to state all that is necessary to the proper construction of mill-work; and gives a description of bevel and spur geer, of coupling, the best modes of disengaging and re-engaging machinery, of the equalization of motion, and some general observations on mill-geering. The moving powers come next to be considered, and under animal strength, wind, water, and steam, the best mode of applying these comes to be considered; at the conclusion of these we have an account of the flour-mill, from which a very correct notion of the manner of imparting motion from the water wheel, or leader, to other parts of machinery is given. The strength of materials, which is a matter of such paramount importance in the construction of all sorts of machinery or mill-work, comes next to be considered, and a letter from Mr. Rennie, Jun. to Dr. Young, describing a series of very satisfactory experiments made on this subject, is inserted. A description of hydraulic engines next follows: and these are succeeded by certain simple machines acting as accessaries to our manufactures. So that by the time the reader has advanced thus far, he will have become so thoroughly intimate with machinery, as easily to comprehend and appreciate the several excellencies of our different manufactures, which are next unfolded to his view. The whole is concluded with a well written and able article on that subject which at present excites so much interest in Britain—Railways and Locomotive Engines.

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* The Operative Mechanic and British Mechanist; being a Practical Display of the Manufactures and Mechanical Arts of the United Kingdoms.—By John Nicholson, Esq. Civil Engineer. London; Knight & Lacey. Glasgow; W. R. M'Phun. 1825.

From the excellent arrangement which is thus adopted, and the masterly manner in which the different articles are written, we are led step by step from the consideration of the simplest principles to the understanding of the most complicated and important machinery; and it is impossible to withhold our mite of praise either from the arrangement or the execution of the work. Every machine which is used in arts or manufactures—every method of applying the various moving powers—in fact, every thing which is necessary for the engineer or the mechanic to know, is here fully developed and explained; and with this work at hand, no practical man need be at a loss in the erection of any machinery which may come in his way. We cannot this week give any extracts from the work, but we shall on some future occasion take an opportunity of quoting from it.

We cannot, however, conclude our remarks without adverting to the plates, many of which are very defective: some of the figures wanting the necessary letters of reference; and some of the plates having figures deficient altogether. This shows extreme carelessness somewhere, and ought not to have been. We hope, however, it will be attended to in the new edition, which, we understand, is about to be published in Numbers. The success which has attended the publishing of the first edition, has induced Messrs. Knight & Lacey to yield to the wishes of many individuals who were unable to purchase it all at once, and to divide it into twelve half crown parts, to be published weekly. The first part is announced, we observe, to be published this day, Saturday the 4th of June; so that this really valuable work will thus be brought within the reach of all; and particularly of those to whom it is likely to be most useful.

PEN'S TABLES. [*]

This little work is another added to the list of those which the working mechanics of the present day have given to the world, for the benefit of their fellow-workmen; and if the Tables are correct, (which we have èvery reason to think is the case,) it must prove extremely useful to those who are in the habit of using much iron. Wrought iron has become an object of very general use for almost all mechanical purposes; and there cannot be a doubt, that a set of Tables calculated to ascertain the weight of any given length of bar iron, whether round, square, or flat, must be of great utility to those who are in the habit of using them. These Tables give the lengths and weights of square iron, (from ¼ inch to 5 inches square,) from 1 foot to 18 feet; of round iron, (from ¼ inch to 5 inches diameter,) from 1 foot to 18 feet; and of flat iron, (from ¼ of an inch to 1 inch thick,) from 1 foot to 18 feet; besides several other useful Tables connected with those we have mentioned.

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[*] Tables showing the Weight of Different Lengths of Round, Square, and Flat Bar Iron, Steel, &c. By Samuel Pen. Liverpool; F. B. Wright. Glasgow; W. R. *M'Phun. 1825.*

BUSBY MECHANICS' INSTITUTION.

We are glad to have it in our power to record the rise of another Mechanics' Institution, and more particularly when we consider the place, and the persons, with whom it has originated. When a portion of the cotton-spinners, and others, are struggling by means of combination to augment their income, and by these measures, unfortunately, some *bad blood* is evolved, it is highly interesting and agreeable to observe a portion of the same body, raising to themselves a temple of science, where they may meet and enlighten their minds and dispel the mists of ignorance.

Busby is on the river Cart, a few miles to the south of Glasgow, where there is situated a cotton factory and a printfield. The operatives of these two public works, among themselves, lately began a library, which at present consists of 200 volumes, and they have now founded an Institution, called the "Busby Mechanics' Institution," consisting of more than 100 members, which number is rapidly on the increase. On the evening of the 19th May, the Institution was opened by G. D. Longstaff, Esq.—a gentleman of considerable scientific acquirement, and son of the lecturer to the Glasgow Mechanics' Institution, whom they have chosen as their lecturer.

In a clear and perspicuous manner he explained the nature of mechanical and chemical philosophy, upon which he now lectures, and proves to them the advantages resulting to all classes from a knowledge of the principles and details of those sciences. The proprietors of the works are giving them every encouragement; those of the cotton work have fitted up, free of expense, an excellent lecture-room. Mr. Macfarlan, active partner of the cotton work, and Mr. M'Gregor of the printfield, are members, and the class have nominated the former president, and the latter vice-president, of the Institution.

This we believe to be the first public work in Scotland, the operatives of which have founded an Institution with a regular and scientific lecturer. It is a very laudable and spirited example to other public works of the same kind throughout the kingdom, and we are certain it requires only to be known to be as quickly imitated.

GLASGOW MECHANICS' INSTITUTION.

The first general meeting for this *year, under the* constitution, was held last Saturday night within the Institution Hall. There was a full attendance of members, especially when it is considered that Saturday was the day for removings. After some very appropriate preliminary remarks from the President, a very able report of last year's proceedings was read by the Assistant Secretary. The statement of accounts was also read, showing that although the Treasurer is presently considerably in advance, yet that the debt contrasted with the Institution property, leaves a balance in favour of the latter of above £1000. We hope to be soon able to lay some of the most important passages of this very interesting report before our readers. After settling the question as to the continuance of the lecturer on chemistry and mechanics, the meeting proceeded to make up the list of nominees, out of which the deficiency in the Committee is chosen. This part of the proceeding was attended with much good humour, and a highly respectable list was made up. Votes of thanks were then passed to Mr. Longstaff for his gratuitous lectures on astronomy; to Mr. G. D. Longstaff, for his very able assistance to his father; to the donors in money, books, and apparatus, and to the eight gentlemen retiring from Committee. The meeting then proceeded to consider a suggestion for an alteration in the mode of electing the Lecturers. The constitution vests this right in the members of the Institution at large. It was now wished to confine it, in the first instance, to the Committee chosen by the class and responsible to them; but still leaving it to the members, at the close of each session, to continue or remove the lecturer, according as he gave satisfaction. The arguments in favour of the proposed alteration were stated at considerable length by one of the members, on which an interesting discussion ensued, and the sentiments of the meeting being apparently against the alteration, the mover withdrew it for another proposition—that the Committee should be authorised to recommend such candidate as appeared to them the most fitted for the office, which latter suggestion was adopted. The meeting did not break up until eleven o'clock, and was highly distinguished for order, harmony, and good sense. The Institution meets on Saturday se'ennight, to ballot for the Commitee, from the list of nominees, and transact any other general business.

ON WATER-TRAPS.

GENTLEMEN,—I observe in No. LXXIV. of the present Volume of your Magazine, certain remarks by Mr. Saul of Lancaster, respecting water-traps. This writer has certainly a happy nack at suggesting improvements which happen to be well known, at least at and about Glasgow. The water-trap he mentions, I have to inform him, is nothing new; there is hardly a jaw-box in a moderate sized lodging here without one on the same principle, with a screw on the one side for cleaning them out occasionally. I have also seen such as he describes used with great advantage where water was to be carried from the interior of a building into the street common sewer, to prevent rats gaining admission therefrom.

The one I proposed, (owing to the peculiar formation,) is expected to keep itself clean, which could not be the case in the one he proposes. If he would take the trouble to look over the article again, I doubt not but he will see the usefulness of the one proposed.

I am, GENTLEMEN,
Yours, &c.

J. W.

Glasgow, 23d May, 1825.

ESSAYS ON BLEACHING,

By James Rennie, A. M. Lecturer on Philosophy, &c. &c., London.

No. I.—HISTORY OF THE ART.

SECTION III.

A still greater improvement in this art was made between twenty and thirty years subsequent to Dr. Home's publication on the application of chlorine to bleaching. The manufacturer is indebted to the distinguished French chemist, Berthollet, for the addition of so important and powerful an agent to his apparatus. This substance was discovered by Scheele in 1774. Its property of destroying vegetable colours was soon after ascertained by the illustrious discoverer, and detailed experiments on this property were given by him in the Transactions of the Swedish Academy of Sciences, of which papers of Scheele we have a translation by Dr. Beddoes. This property excited a lively interest among the chemists of the day, and gave rise to many ingenious experiments besides those of Scheele, most of which appeared to be more amusing to philosophic curiosity than useful in the advancement of so important an art as bleaching. But such experimental amusements are seldom destitute of utility and important results, even though at first sight they may appear to be fanciful or trifling. The wild dreams of the Alchymists laid the foundation of the most interesting of the sciences, and lighted a torch which the splendid discoveries of our contemporaries have kindled to a blaze; the speculative experiments which were made on chlorine, merely to gratify a passion for chemical research, have been turned to advantageous account in an important branch of our manufactures. It was no less than ten years after the discoveries of Scheele, that chlorine was applied to *practical* bleaching. The first account of this application is given by Berthollet in the Journal de Physique for 1785, and in the Annales de Chemie. tome I. From the details there given, and from papers published by the same chemist in the years immediately succeeding, we learn that the mode of bleaching by chlorine was carried on to a considerable extent in various parts of France.[1]

The history of the introduction of Berthollet's method into Britain has given rise to some disputes, which I think it of some importance, though of some difficulty, to settle. Parkes states, on the authority of Professor Copland of Aberdeen and the present Duke of Gordon, that, when travelling on the Continent, they learned the process from Saussure of Geneva. The Professor, foreseeing the advantage which his countrymen would derive from a knowledge of this, made himself master of the requisite manipulations, and immediately on his return communicated the important information to several bleachers at Aberdeen. This was so early as July 1787, but two years subsequent to the invention of the method. The Aberdeen bleachers first used a Woolfe's apparatus, but the inconvenience of glass vessels in extensive works, obliged them to have recourse to those made of white wood. This seems to have been the first introduction of Berthollet's method into Britain.

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[1] It is somewhat ridiculous to observe it stated in Ree's Cyclopedia, (Art. Bleaching,) that the first practical application of chlorine was made in the Spring of 1788 in London, at the suggestion of Dr. Kirwan, who had learned the decolourizing property of the substance directly from Scheele.

It was not till the following year that Mr. Watt of Birmingham was instructed by Berthollet himself in the art, which, without impropriety, might then be called new, so complete was the revolution caused by this useful invention.[2] Mr. Watt was impressed with the importance of the improvement, entered upon experiments with all the enthusiasm of genius, and actually applied it to practice, by bleaching 1500 pieces of cloth, a circumstance which he mentions in the above-mentioned letter: but he did not persevere in the practice of the art, owing, most probably, to his local distance from the seat of the cotton and linen manufactories. But the knowledge of the process which had been acquired by Mr. Watt was not lost. He communicated a portion of his own enthusiasm to several scientific and enterprising persons about Manchester, who entered with keenness and alacrity upon the practice of bleaching by chlorine. In Ree's Cyclopedia, it is said, that the Manchester bleachers, as well as Mr. Watt, received their information from Kirwan, who is there said to be the original suggestor. Be this as it may, the year 1788 had not elapsed, when Dr. Taylor and Mr. Cooper of Manchester bleached, for the purpose of experiment, a piece of cotton goods by this process, had it printed, calendered, and fit for the market in less than three days. Exulting in the success of his experiment, Mr. Cooper, together with several other enterprising manufacturers, commenced a bleaching work at Raikes, near Bolton, where Berthollet's discovery was applied on a very extensive scale. We are informed by Mr. Parkes, that, in these works, there is at present (1815) consumed many tons of sulphuric acid every week. Mr. Henry of Manchester, not only formed a similar establishment, which his increasing practice in medicine, and the dishonourable conduct of a partner, obliged him to abandon, but generously instructed the principal bleachers in this country in the method, of which, at this period, there was no practical account published. The method of Mr. Henry at first consisted, sometimes of immersing the goods in a watery solution of the gas, or in an alkaline ley impregnated with it; and sometimes in exposing the goods, previously moistened with water, to the action of the gas itself. Soon afterwards, he made a farther improvement, in substituting lime for alkali as a means of condensing the gaseous chlorine, which was exclusively applied to white goods.[3] An air-tight chamber was constructed, on the floor of which was spread a stratum of lime, mixed with water to the consistence of cream. Through this the goods were passed by means of a wince, and the chamber being filled with gas, the goods were exposed alternately to the calcareous liquid and the acid vapours. An oxymuriate of lime was thus formed on the surface of the cloth, which, after the operation had continued for a sufficient length of time, was taken out and exposed to the usual processes of washing, crofting, and finishing.

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[2] Since the publication of Mr. Parkes' Essays, however, this statement has been corrected by Dr. Henry in a letter to Dr. Thomson, dated Oct. 1815. From this it appears that Mr. Watt was acquainted with Berthollet's discoveries so early as the beginning of 1787, as he expressly says in a letter, dated Feb. 23, 1788, "I have *for more than a twelvemonth*, been in possession and *practice* of a method of preparing a liquor from common salt, which possesses bleaching qualities in an eminent degree; the inventor is an eminent chemist and philosopher at Paris." (Ann. Phil. VI. 423, in a note.) This, therefore, must have been several months prior to the *commencement of the works* at Aberdeen.

[3] See Ann. of Phil. VI. p. 422.

Early in the year 1788, an attempt was made in England by some foreigners, De Bonnevil & Co., who had modified the plan of Berthollet, to obtain a parliamentary grant for the discovery of a new method of bleaching; and failing in this, to obtain a patent-right for their pretended discovery. Mr. Watt, however, who had previously been made acquainted with Berthollet's discovery, resisted this monopoly, and was joined by Mr. Cooper and Mr. Henry, whose successful experiments we have already mentioned. An opposition from so respectable a quarter was effectual, and the foreigners were foiled in their attempt to obtain a grant. Mr. Henry individually presented a legal petition in due form against the patent, and was successful in opposing it. His petition, dated July 2, 1788, contains every thing at present known relative to bleaching, except the condensation of chlorine by means of lime, a thing which he afterwards accomplished, (see Ann. Phil. VI. 424.) The agent which these foreigners employed in their process, they called Liqueur de Janelle, from the name of their native place. It was prepared by receiving the gas which arises from the distillation of three pounds of muriate of soda, and one pound of manganese, into a receiver containing one pound of the best American pearl ash dissolved in four pounds of water. For the purpose of extricating the gas from these materials, two pounds of sulphuric acid diluted with four pounds of water, was held to be sufficient. I am not quite sure if the inventors of this liquid have received all the praise which is due to them. It is certain that they did not learn the process from *Berthollet,* as he only found it out by analyzing the liquid prepared by them.

Next year, 1789, Berthollet published, in the Annales de Chemie, a very circumstantial account of the system, with ample directions for the construction of the apparatus. From this it appears, that gas bleaching was now adopted in various parts of France, and would have been universally employed, but for want of a convenient and safe mode for its production and application. These obstacles Berthollet subsequently overcame by the most ingenious inventions of apparatus, of which he has published an account in the Annales de Chemie. Previous to this, gas bleaching was conducted in England upon a very imperfect method, and the manufacturers were ignorant of any other mode of using the chlorine except the gaseous state. At Nottingham, for instance, small parcels of linen yarn, linen and cotton hose, and the like, were bleached by being suspended within large wooden boxes, each of which had a close bottom capable of holding water. Into these gas was conveyed, and, to prevent any injury by its immediate application, the goods were, by means of a frame and pulley, frequently let down into the water at the bottom; by which method it was difficult to get all the surfaces of the goods equally exposed, without which bleaching must always be imperfect. This mode, however, was ingeniously improved by Mr. Rupp of Manchester, who has given a plate and a description of his apparatus in the 5th vol. of the Manchester Memoirs.

We have mentioned above, the improvement which Mr. Henry made in the application of chlorine by the intervention of a calcarious mixture applied to the cloth. This, it must be confessed, was a considerable advance towards perfection:

but was found to be both inconvenient and dangerous to the workmen, from the disengaged state in which the gas remained in the vessel before combining with the lime; while the chance of the goods being unequally exposed, rendered it somewhat uncertain. It was reserved for Mr. Tennant of Glasgow to remove these difficulties, by the discovery of a method of combining chlorine with lime in a separate vessel, which contained lime suspended in water by mechanical agitation. The redundant lime was allowed to subside, and a clear liquid, which was a solution of the oxymuriate of lime, was applied properly diluted to the purpose of bleaching. "It is worthy of remark," Dr. Brewster observes, "that this combination, even when the chlorine is perfectly neutralized, has the power of bleaching light or thin goods, though it is much less active in discharging some vegetable colours." Hence this method has certainly a great advantage over all former ones, in the facility and safety of its application, especially to coloured goods, which would have their colours discharged by the contact of either the acid or the quicklime in an uncombined form. This discovery was secured to Mr. Tennant by a patent, dated January 30th, 1798, which has since been set aside by a legal decision.

Nearly about the same time, the French chemists and practical bleachers made considerable improvements on the mode of Berthollet, chiefly in the apparatus, and in the use of a combination of potash with chlorine. These are detailed in a work by Des Charmes, which, as a practical treatise, is above all praise, and to which I hold myself greatly indebted for important information. Sometime previous to this also, the trustees *for the linen and hempen* manufactures in Ireland, published a report of experiments to ascertain the merits of the several bleaching liquids prepared from chlorine, which contains some useful knowledge and rationales not before published. This was followed in the same quarter by Kirwan's accurate experiments upon the different alkalies used in bleaching, who first showed the bleacher how to ascertain the qualities of those important agents. Mr. Higgens of Dublin, also, whose chemical abilities are well known, discovered a new agent, namely, sulphuret of lime, which he recommended in a small work on the theory and practice of bleaching, published in 1799. This has never come into general use, so far as I can learn. There seems, indeed, to be some peculiar nicety in the management, which renders its application, in the hands of the inexperienced, liable to uncertainty. From this circumstance, some of the bleachers of Glasgow who attempted to introduce it, had their goods corroded and destroyed.

At a still later period, say 1800, Chaptal made several experiments on the application of alkaline vapours to bleaching and washing. These were published in the several Scientific Journals of Europe, and detailed at some length by D'Orelly, in his Essai sur le Blanchament.

Mr. Tennant, however, still retains a patent for manufacturing the dry oxymuriate of lime, the discovery of which is among the latest and most interesting improvements in chemical bleaching, as it acts with greater safety and effect, while it is not so liable as the other preparations of chlorine, to give out the deleterious gas, which, in the old mode, was so apt to injure the workmen. It can also be carried to a distance with greater ease than any of the liquid combinations, and Mr. Tennant accordingly supplies the bleachers of Ireland and England with oxymuriate of lime, as well as those in the immediate vicinity of his manufactory.

The oxymuriate of magnesia has very recently been recommended by Sir Humphrey Davy and Mr. Ramsay of Glasgow, for clearing the whites of printed calicoes, and promises to be an improvement of considerable importance.

In the apparatus of bleaching, there have lately been radical and important alterations made, some of which are of great utility. The whale boiler may be mentioned as an example of these. It is an ingenious substitute for the old bucking apparatus, and is well deserving of attention. It has been but lately introduced in the bleaching works around Glasgow: its utility, however, I am persuaded, will soon bring it into general use. In proportion, indeed, as the apparatus of chemistry, considered generally, is improved, so will the apparatus in bleaching.

But it is not unlikely that this art may soon be altogether superseded, at least in so far as regards the bleaching of linen goods; if the mode of manufacturing flax, invented by Mr. Lee, ever come to be generally adopted; or, if it be true, that when flax is so manufactured, the linen produced from it can be made sufficiently clear and white by simple washing. It was about two years ago that Mr. Lee took out a patent for obtaining hemp and flax directly from the plants by a new method. He neither steeps his flax nor spreads it on the grass. When the plant is ripe, and it must be allowed to ripen more perfectly than when the common method is followed, it is pulled in the usual way. It is then thrashed by placing it between two grooved wooden beams armed with iron. One of these is fixed; the other is suspended upon hinges, and is made to impinge with some force on the fixed beam; the grooves in the one beam corresponding with flutes in the other. By a mechanical contrivance, almost exactly similar, the woody matter is beaten off, and the fibres of flax left. By passing these through hackles, varying progressively in fineness, the flax is very speedily dressed and rendered proper for the use for which it was intended. The advantages of this process are manifold. The expense of steeping and spreading is saved; a much greater produce of flax is obtained; it is much stronger; the fibres may be divided into much finer fibrillæ, so as to obtain at once, and in any quantity, flax, fine enough for the manufacture of lace. But the greatest advantage is the ease with which it may be bleached. For the colouring matter not being chemically combined with the fibre, as is the case with what has undergone the steeping process, there is nothing more required to whiten it than washing it well in pure water. Dr. Thomson, whose opinion on this subject is of great weight, says, (Ann. Phil. VI. 230,) that he considers this invention as the greatest improvement ever introduced in the linen business, and *as likely to occasion a total change in the whole of our bleach-fields!* I am of opinion, however, that this will not preclude the necessity of bleaching altogether, however much it may facilitate it, for cotton, which is never steeped, and, besides, is much whiter naturally than the best flax, requires to undergo the bleaching process.

IRRUPTION OF MOUNT VESUVIUS, IN THE YEAR 1819.

FROM the period of my arrival in Naples, the irruptions of Vesuvius had been regularly increasing in violence, and I had been advised to make my visit without delay. The party was quickly formed; and we left the city about nine in the evening; my companions were a Mr. M——, a young Frenchman about twenty, who had joined me between Florence and Rome; his uncle, a resident of Naples; and my sister. We reached the foot of the mountain in an hour and a half, at the town of *Torre del Greco*, where we found the guides, which Mr. M—— had previously engaged, waiting our arrival. They were ten in number, with six mules. We had given notice that we were no flinchers, and, therefore, two extra mules were provided to carry provisions, with cordage and apparatus necessary to the nature of the excursion, and to enable us the better to meet any casualty.

The moment any *Inglése* appear in these villages, every member of the population is upon the *qui-vive*, all offering their services, with assurances they are the individuals best calculated for the object in view—having yet, perhaps, to inquire what the nature of that object may be. But they do not alone offer their services—they thrust themselves upon you, snatch up, and even take out of your hands your luggage, or any trifle they can seize on, so as to hope themselves engaged of your party. Their anxiety in this respect is not surprising —this is their sole means of subsistence. The curiosities and phenomena in their locality constitute their crop, if I may so call it, and they gather it in as often as they can force it into maturity. But this alacrity very quickly subsides; they soon yield to the influence of habit and climate, and rarely exhibit the amount of perseverance which the traveller requires. It is the reward which they seek; and they endeavour to obtain it with the smallest amount of exertion and risk.

The necessary arrangements made, the guides lighted their torches, and we proceeded for the mountain. How unlike any thing in England is such a departure! The cries of link-boys and coachmen at the close of our theatres alone furnish some idea of this scene. The garrulity of the Neapolitans is proverbial; they speak all at the same time, each one endeavouring to be heard in preference to his rival. Two or three stragglers joined; and thus we formed a party of about twenty.

Here grow the vines from which is produced the celebrated wine *Lachrymæ Christi*. The natural warmth of the soil can be compared to the less constant artificial warmth of the stove; and the powerful influence of the sun, during so large a portion of the year, assists probably in giving that peculiarity of taste and that excellence so flattering to the palate of the connoisseur. The road is winding, and as rude as our private farm roads in England which have been neglected. We soon found, however, that we ought to have been more content; for the way now became rugged, and narrowed to a path of two to four feet, with loose stones of various sizes, demanding a constant attention. It is indeed surprising to see the care with which the mules proceed; affording such a strong sense of security that the rider unconsciously disregards the perils of the road. From the earliest ascent the ground appears undulating; or rather the rise seems formed by massive folds, checked and frozen, or cooled, more correctly speaking, in its progress downwards. As you proceed, vegetation, which below abounded with the utmost imaginable luxuriancy, becomes restricted, and no longer obscures the real form and appearance of the path, and surrounding soil or rock. After proceeding about two hours, the angle of the rise gradually increasing in our progress, we reached the *Atrio dei Cavalli*, a sort of landing place so called, because the traveller can proceed no further mounted, and must here leave his mules until his return. The almost perpendicular form of the part of the mountain we now had to surmount, has procured for it the name of the Cone.

The mountain had been convulsed during the last three or four days with increasing violence; and at each throe the lava had boiled over the summit of the cone with more or less abundance. I had perceived this from my residence; and as we neared the mountain, the grandeur of each succeeding shock became more awful—for it was no longer the distant view, such as the imagination had been accustomed to contemplate. Illusion was now succeeded by a feeling of excitability, such as I had never experienced. I saw the approaching peril—in another moment dangers everywhere surrounded me, yet was I eager to advance. I can now conceive something of the ardour felt amid the horrors of a dreadful conflict; a sensation wholly novel thrilled through my veins; it was not a sense of fear. I urged the party to hasten their preparations. I felt every moment more eager to proceed, and the danger never suggested itself as an obstacle.

But the labour in reserve had often damped the ardour of previous travellers, and our guides informed us it would be necessary before we proceeded, that we should take refreshment. It was midnight;—refresh ourselves at the foot of the cone of Vesuvius, during constantly increasing irruptions—lava overflowing its mouth, and running like a river down its sides—the thunder roaring beneath the trembling crust on which we stood—refresh ourselves! impossible! But not so with the guides: aware of the labour in reserve, they quietly seated themselves upon pieces of calcined rock to their supper, with the most perfect indifference and undiminished appetite; telling me with the greatest *nonchalance* I need not be impatient—the irruptions were rapidly increasing in violence—and I should soon have enough to gratify my utmost wishes.

My mouth was really parched with a sense of the surrounding scene, combined with the anxious anticipation of the future, I therefore willingly partook of the wine, but I could not eat. While this tedious meal proceeded, I made some necessary inquiry. At length all again was bustle, and the guides began to harness themselves. The apparatus they fit to their shoulders is very like that used to assist our porters in the use of their barrows; or like the braces adopted to keep back the shoulders of our boarding-school ladies; but extending behind ten or twelve feet in length, and ending in a noose: so that when the guides, by the help of a long staff, proceed in pairs from crag to crag, the traveller, holding the noose of each, follows with the utmost facility, in situations apparently inaccessible. Two of the ablest gave their harness to my sister, and I was indeed highly delighted with the harmonious exertions of this extraordinary trio. I refused assistance. It appeared to me that I should not make myself thus dependant without necessity; and I proceeded with all possible diligence in their track.

Every account of this volcano, its appearance and phenomena, that I have hitherto seen, seems to me defective, as mine also will seem to every other traveller;—probably, from the circumstance that the situation of the mountain is ever changing; and from the amount of matter and innumerable stones thrown out, and the quantity of lava flowing during a considerable irruption, the surface cannot remain with the same appearance during two succeeding days. The cone appears to consist of a mass of fragments of blasted rock of all dimensions, from the size of an ordinary pebble to that of the body of a coach; and one piece was shown to us, which had lately been thrown up, as large as a first-rate house. They were nearly all of one colour—a dark brown approaching to black; for they had all been fused in the same furnace, and all bore more or less the marks of fire. Some were like masses of marble, so smooth that with difficulty we kept our footing upon a slight inclination; others were of the common pumice stone, and these were mixed with quantities of melted minerals. Between and beneath these appeared occasionally considerable tracts, furrowed with rivers of lava emitted on many previous irruptions, exhibiting a surface resembling our ploughed land, but as hard as granite. Climbing up without a staff, I very early found it necessary to use hands as well as feet and knees. Never will I forget my surprise, when, on slipping from a loose fragment, I seized on another to arrest my sudden fall into the regions I had lately with so much difficulty left behind, and found its surface to consist of innumerable points, too minute to be readily perceived, but very sensible to the touch, as I often had occasion to experience during this, to me, ever memorable ascent. These fragments appeared detached pieces of lava. The north side of the mountain had, besides a fair share of rocks and stones, an immense assemblage of ashes and cinders, which, from their lightness, had been blown by the south wind to this quarter.

We had been proceeding about an hour during ordinary shocks, when the thunders below simultaneously arrested the whole of the guides, who called out to us to be upon the watch. The rolling increased—the mountain heaved, and—how faint will be the description! Imagine the explosion of ten thousand pieces of ordnance—imagine ten thousand rockets darting at one instant into another region; add their hissing to the detonating explosion, and you approach the tremendous effect produced.

A million red hot fragments flew into air, like so many bombs from one terrible mortar—a volume of flame succeeded, which seemed to light up the earth—the heavens—all nature! And before the senses could embrace the sublimity of the scene, the crash of falling clouds of rocks and stones reminded us we had better rouse from our stupifying astonishment, and look to our personal safety. Immediately succeeding the discharge of missiles, appeared another wonderful source of stupendous grandeur—the caldron boiled over, and the lava, a magnificent river of liquid fire, rushed from the crater in majestic flood. As soon as relieved from the immediate danger of the late volley, our guides had assembled, and while I was in the fever of contemplation, they announced that the next succeeding explosion would be yet more severe, and we must retire. I laughed at them so soon as I could get sufficient command over my anger; but laughter would not do. I then threatened a refusal to pay;—they had too much reliance upon an appeal to their police, I presume, to allow that to operate. At last, I said, "retire, if you please—we proceed to our destination." They stared—consulted a little—jabbered something about *Inglése*, and, at length, advanced. We proceeded onward about twenty minutes, observing slight intervening shocks, when we had once more occasion to halt. The flame had nearly subsided shortly after the last explosion, and had been succeeded by an immense body of black dense smoke. This too had become lightened; but, in sympathy with subterranean thunders, which again seemed to approach from considerable distance, the volume of smoke thickened, seemed to fill the crater, and rise into the higher heavens. Either the guides had not been mistaken in foretelling increased violence; or greater self-possession allowed me to feel more intensely this new shock. It seemed to me the full meridian of magnificent nature!—terrible in its tones—terrible in its aspect—terrible in its power!

The stones rattled around us as they fell, yet we again escaped. But the guides now spoke in a tone of resolution, and insisted upon our immediate return. Two of them, without consultation, had decamped, and one was already at a considerable distance. Some knowledge of human nature had taught me, however, the advantage of finding a weak place; I told them to go; they had done more than I had expected from Neapolitans; I and my friends would proceed, and my sister, I said, would show them what courage could perform, and would throw shame upon their sex. They altogether clamoured vociferously at our madness—we answered this "dialect of many tongues" with a contemptuous smile, and a movement in advance, and observed them first look after their descending companions, and next call to them to return:—but these had learned that "Charity begins at home."

(To be continued.)

LETTERS AND QUERIES.

GENTLEMEN,—It would be conferring a lasting obligation if you or any of your numerous Correspondents would inform me the best method for preserving or hardening stucco busts, without defacing the figure.—By attending to the above, you will not only be conferring a particular favour upon me, but, I am certain, upon many others as desirous of the like information as I can possibly be.

Yours, &c.

A. R.

Glasgow, 23d May, 1825.

GENTLEMEN,—If you or any of your ingenious Correspondents would solve the following query, it would be considered a particular favour:

In looking through my window, one of the cross spars of which coming in contact with my eyes, I observed the letters of a sign-board, on the opposite wall, doubled. What is the reason of this apparent phenomenon?

Simple as this question may appear, I have never been able to get a satisfactory answer to it, though I have applied to persons who, from their learning, I considered capable of answering it. I am therefore of opinion that your valuable Magazine is the best medium through which I am likely to obtain the desired information, should you be pleased to insert it.

Though it be a question of no general utility, yet an inquisitive mind always wishes to know the causes of things.

Yours, &c.

INQUISITOR.

Glasgow, 30th May, 1825.

GENTLEMEN,—It would oblige a constant reader of your Magazine, if some of your Correspondents would give a criticism on the architectural style and taste of the public buildings now erecting in Glasgow; such as, the Bridewell, the Ramshorn Church, the new English Chapel, the Police Office, and the like.

Yours, &c.

A CONSTANT READER.

Glasgow, 19th May, 1825.

GENTLEMEN,—If any of your Correspondents could tell the best method of ingrafting fruit trees, it would much oblige,

Yours, &c.

J. R.

Woodside, 25th May, 1825.

What is the reason that grates with cross bars reflect less heat than those with upright bars?

S.

MISCELLANIES.

Table Land, Cape of Good Hope.—The top of Table Land is nearly level, and appears to be about one mile and a quarter long, and half a mile in breadth. The surface consists chiefly of a rock, but in some places there are thick layers of a black mould, resembling decayed vegetable remains. It was among this that the stock of an anchor was once discovered half under ground. A circumstance so extraordinary, gave rise to much speculation and astonishment at the time it occurred; and Barrow the traveller, who visited the spot soon afterwards, theorized at considerable length upon the subject. However, the matter was eventually explained to the satisfaction of every one. It appeared that a party of young men had, in a frolic, carried the stock of the anchor to the top of the mountain, either for the purpose of deciding a bet, or with the intention of perplexing and misleading those scientific travellers who might subsequently ascend Table Land. If they had merely the latter object in view, they doubtless had frequent reason to congratulate themselves on their success; for it is well known that theories, both geological and antiquarian, have been founded upon deceptions even less artful than the one now alluded to.—*Howison's For. Scenes.*

Constantia Wines.—My next excursion was to the two farms of Constantia, where the celebrated wine of that name is made. These farms have the same appearance as other cultivated spots in their neighbourhood, though they alone produce the grapes to whose delicious essence they owe their celebrity. The proprietor of Little Constantia informed me, that he had marked off that part of his domain which produces the peculiar grape from which the wine is made; and that vines, planted only a few feet beyond the boundary line, yielded a very different and inferior sort of fruit. It would be desirable to analyse the soil of these farms; for the richness and exquisite flavour of the Constantia grapes must altogether depend upon some peculiarity in its composition, as, from the limited extent of the farms, it is impossible that there can be any variety of climate upon them. The proprietor of Little Constantia is a Dutchman, and has a handsome house upon his estate, which, though small, yields him a larger revenue, I believe, than any agricultural territory of similar extent in Europe. His cellar is 140 feet long, and a range of immense casks, all of which are full of wine every vintage, occupies each side of it. Here we drank the liquor in purity and perfection; but it was so rich that I could hardly finish the second glassful.—*Howison's Foreign Scenes.*

NOTICES TO CORRESPONDENTS.

Mr. Paterson's Blowing Engine is in the hands of the Engraver, and will have a place next week. If our maggoty friend in Lanark will send us a more particular description of his machine, it shall get a part of our Plate. A. B., J. B. H., A. M., &c. have been received.

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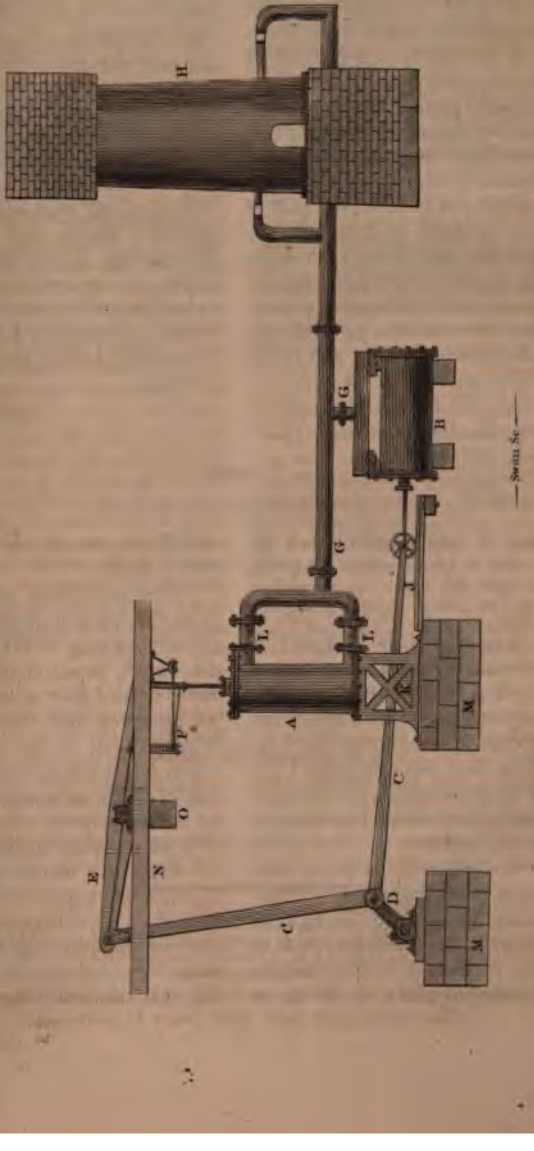
THE GLASGOW
ECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

> " Man loves knowledge, and the beams of truth
> More welcome touch his understanding's eye,
> Than all the blandishments of sound his ear,
> Than all of taste his tongue."

No. LXXVII. *Saturday, 11th June, 1825.* Price 3*d.*

PATERSON'S IMPROVED BLOWING ENGINE.



Vol. III.

IMPROVED BLOWING ENGINE, BY MR. PATERSON, LANARK.

The improvement in this blowing engine, is, that by the use of two cylinders blowing alternately, the blast is equalised without either a water-pressure or an air-vessel; and thus, without the aid of these, and with less weight upon the moving power, whether steam-engine or water-wheel, a constant and steady blast is obtained.

I have used a machine of this kind myself for some time back, which is driven by a water-wheel of five horse power, and I find it to be much preferable to a blast from one cylinder. I can smelt at least one-third more iron with the same quantity of coke, and make larger pigs; and besides, the iron is much more fluid or better fused, than was the case when I used the blowing engine with one cylinder. I farther consider it a great advantage for the machinery, as it entirely does away jolting, the crank being alike strained at all points.

A, (see the Plate,) the upright cylinder; B, the horizontal cylinder; C, C, the two connecting rods; D, the crank; E, the walking beam; F, the parallel motion; G, the pipes for conveying the blast to the cupola; H, the cupola or furnace; *I*, the small wheel, running upon a cast iron bar, with a groove in its top, in order to keep the piston rod parallel; K, is two cast iron plates standing on edge, to allow the connecting rod to move between them, and to support the upright cylinder; L, L, the chests where the valves are placed to admit the air into the upright cylinder; but they cannot be shown in the plate. The valves in the horizontal cylinder are fixed to the ends of the cylinder, and open inwards to admit the air into it. M, M, the pedestals for the cylinder and crank to be fixed upon; N, the spring beams for carrying the walking beam; O, a beam to go across the house to support the spring beams and the walking beams.

James Paterson.

ON MAKING CANDLES.

The art of candlemaking has received less improvement from the science of chemistry, than almost any other of the manufactures of Great Britain. This is partly to be attributed to the almost general use of coal gas, which, rendering the consumpt of candles less, has consequently caused less attention to be bestowed on their manufacture. Although the use of gas has become general in our streets, shops, warehouses, workshops, and even in some of our private houses, still a great proportion of workshops and private houses are indebted to the light of candles for a considerable part of the year, especially in large towns, and in confined parts of them, in which, in general, the manufactures are situated.

Were an Indian, who had never seen the making of candles, to become desirous of trying his hand, he would, in all likelihood, fall exactly on the plan which is pursued at present; and why should we, who pretend to be more enlightened, leave the manufacture of this useful article in so degraded a state? It is well known to practical candlemakers, that during summer, in dipping, the candle gets soonest thick at the top, but small below; while in winter, the reverse of this is the case; and in a medium temperature, things of course go on better. The only difficulty then, in the first period, is to have the tallow of a proper and uniform temperature throughout, and this temperature necessarily varies according to the temperature of the air. This is the principle mystery in candlemaking. Now, if a set of experiments were made, taking the temperature of the air first, marking that down; then taking the temperature of the melted tallow, at which it is found to "take on" best, and that also marked down; as the heat in this part of the country does not range more than 60° ; it would be a very easy matter to have a thermometer, with all the degrees distinctly marked on the left side of the scale, and the degree the melted tallow ought to be of, marked on the right side of it, at which, from experiment, it had been found "to take on" best. At present, the heat is judged of merely by the sensation it gives to the finger, which is at best only a very uncertain criterion. A set of experiments ought also to be instituted on the proportion the wick ought to hold to the tallow; the length of time it takes to burn down, with a small and with a thick wick, paying particular attention to the light it gives; nay, the degree of light ought to be accurately measured and marked down. This last refers also to moulded candles. The fineness of the cotton adds greatly to the light, and does not consume the candle any faster than the coarse, dirty, ill-carded, and ill-spun kind. I think, therefore, that the makers are wrong in saving from this particular.

Every place has its medium temperature. In Glasgow, it is, I think, about 47°. Now, if that temperature is found to "take on" well, in some of our old wrought out coal pits, about 50 feet down, (where the medium temperature will be found,) a room might be dug out of one side, having a scaffolding across; if the pit goes farther down, it would be an advantage, because it would draw off all the superfluous water. There you might make candles all the year round at your leisure. If the air was bad, it could easily be renewed by many well known methods. Some of these pits may be had in the neighbourhood of Glasgow, cheaper than ground could be feued, and why should not they be turned to advantage here as well as in Newcastle? In the old coal pits there, all the shot is made.

Another mystery in candle making, is cutting the wicks, and twisting all alike and straight; and also in dipping slowly, and with a steady hand. Now, all this may very easily be accomplished by steam; which would also melt the tallow, and pump the water from the pit if it was tried there. S.

ON THE INTRODUCTION OF STEAM, AS A MOTIVE POWER FOR VESSELS.

GENTLEMEN,—It is very generally understood that Mr. Jonathan Hull was the first person who either proposed, or attempted to introduce steam, as a moving power for propelling vessels by means of paddle-wheels. I perceive, however, from Capt. Savary's "Miners' Friend," a work published by that improver of the steam-engine, and in which he narrates his inventions with regard to steam, and their probable uses, he proposes that steam should be applied to the propelling of vessels. It will thus be seen that though steam has only recently been brought into general use as a moving power for vessels, the idea of this application of it is by no means so recent as has been conceived; but is nearly coeval with its introduction as a moving power. Your affording this a corner of your valuable Magazine, will oblige

A Friend.

EXPERIMENTS MADE ON SIX DECAPITATED ROBBERS.

On the 14th October, 1811, six highway robbers were beheaded near Marburg; one of them was sixty years of age, the other five from twenty to thirty. At the instant when the head of the first fell, the trunk got up again as if the individual had been about to rise upon his feet, while the bodies of the others fell down flat at the very moment. When a little after the heads were thrown at the foot of the scaffold, we saw all the muscles of the face of the last executed completely relax, while those of the old man presented a general contraction, which lasted for a considerable time. These opposite effects took place without the occurrence of any difference in the mode of decapitation to which they could be attributed: with respect to this, it will not be useless to remark, that there remained at least two vertebræ attached to each of the heads. It was observed, that, at the moment of decapitation, the muscles of the face of the greater number of the heads contracted in a convulsive manner. As the head of the first decapitated had not been brought with the rest, no other observations were made with regard to it. The second, which fell ten minutes after it, was observed without loss of time. It was tried at first to excite a contraction of the iris, by pricking that organ, but no apparent motion was obtained. The same operation having been made upon the iris of the third head, the pupil dilated a little, and again quickly contracted; while, at the same time, the pupil of the other eye (which had not been pricked) contracted, and again immediately delated; an effect which Professor Trenderoth, as well as Messrs. Bunger and Herold, who were also present, saw in the most evident manner. Some minutes after decapitation, the bodies were opened, the heart contracted and dilated alternately with much force, in such a manner as to produce regular pulsations. At the end of ten minutes, these motions had, it is true, abated a little; but they were always incessant, and the alternate contraction and dilatation preserved their regularity. Five minutes later, these motions had become unequal and very weak; they revived, however, when the heart was irritated by pinching it. A mechanical irritation made upon a branch of the great sympathetic, accelerated a little the motion of the heart, but only for a minute at most; the motion itself, however, continued for a long time, only decreasing in intensity. A puncture made in the transverse muscle of the abdomen of the same body occasioned strong convulsions, especially in the lower extremities, and yet the nerves had not been immediately irritated. A mechanical irritation made at the lower part of the spinal marrow caused violent contractions in the muscles of the trunk, as well as in those of the neck, particularly those of the upper part, at the place of the section (which had already been frequently remarked). On irritating the upper part of the spinal marrow of another head, convulsive motions were produced in the muscles of the face, and there resulted a movement of the tongue and surrounding muscles. In the third body, a motion was remarked in the lower part of the trachea which remained attached to the trunk: this motion was accompanied with a sort of hissing, an effect caused, without doubt, by the convulsive contractions of the muscles which had been cut. Similar motions took place in all the others. The head of the last decapitated was transported to the theatre, which, on account of the distance, occasioned the loss of an hour. Here, our first care was to try the duration of the galvanic irritation upon the different muscles of the head. The elevator-muscle of the upper eyelid, and the superior oblique muscle no longer contracted; but the frontal muscles, the orbicularis palpebrarum, masseter, digastric, &c. still continued to contract. The contraction ceased first in the masseter muscle; they were prolonged in the buccinator. Two hours after execution, it had entirely ceased in all the muscles, and it could not be excited on moistening them anew. In another head, cut off twenty minutes at least before the preceding, the galvanic irritation caused the depressor commissuræ labiarum, the orbicularis palpebrarum, and masseter, to contract; this latter always much longer than the others. Two hours and three quarters after decapitation, the muscles of this head appeared to have lost all irritability. Before concluding our experiments upon the head of the last decapitated, we exposed the pectoralis major and minor of a body which was brought in. The large pectoral muscle alone contracted under the influence of the galvanic fluid, the muscles of the abdomen no longer contracted; contraction took place only in the right triceps muscle, and in the sartorius; they ceased always in the latter half an hour sooner than in the other. Irritation applied to the transverse muscle of this body no longer produced contraction, which we attributed to the circumstance that the body had been opened at the place of execution, after the first experiment. In another body which had been opened at the same time, the application of galvanism also produced some motions, as well as a feeble contraction, which was not renewed: mechanical irritation produced none. An hour and a half after execution, the natural motion of the heart had ceased in the bodies already carried to the theatre. We were still, however, in hopes to produce contraction by means of irritation, not being able to get at the heart of the body which had been first opened, we proceeded to that of a body which had been newly opened. This last had also retained its heat, principally in the internal parts; the heart still contained a little blood, of a deep colour, in the left ventricle, which was partly fluid and partly coagulated; but we could not, either mechanically, or by means of galvinism, excite any contraction of the muscular fibres of the heart.—*Schriften der Gesell der Gesammt Naturwiss zu Marburg*, Vol. I. 1823.

ON THE SUN'S DISTANCE.

Gentlemen,—While perusing in No. LXVII. your method for finding the distance of the sun, I observed an error in your calculation, page 184, (Vol. III.) which I here take the liberty to point out.

You make the sun's distance 95,070,110 miles, while by *your method*, I make it 95,070,182 miles; her true distance, therefore, must be

95,070,182 miles, and the difference will be 72 miles.—I have wrought the question, and marked with an asterisk the place where the error lies.

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ESSAYS ON BLEACHING,

By JAMES RENNIE, A. M. Lecturer on Philosophy, &c. &c., London.

No. II.—BLEACHING APPARATUS.

SECTION I.

As many of the most useful improvements in bleaching, consist in ingenious inventions of machinery and apparatus, by means of which the chemical agents employed are economised or rendered more efficacious, it would be unpardonable in an essay of this kind to omit their consideration. Such improvements also often depend on a minute acquaintance with the chemical composition of bodies; and inconveniences, which previously could not have been foreseen, may, by a skillful chemist, often be avoided, or at the very least explained; and nobody need be told, that when a difficulty is once understood, it is half overcome. A good instance, among others, of the use of chemistry, as it regards merely the apparatus for bleaching, may be seen at page 296 of the present Number.

It is, however, no easy matter to obtain accounts of these, as the inventors commonly conceal their improvements in order to benefit by them; and it is usually a considerable time after an improvement of this kind has been made, that any account of it is given to the public. When patents, indeed, are taken out for such inventions, we can obtain descriptions of them from the specifications, but patents are not always sought, even for improvements of much importance, and in this case we must be contented to remain ignorant of their existence till they come into general use. I shall not take time to describe such machinery and apparatus as has now been disused, but shall confine myself to the consideration of what is at present employed by the most enlightened bleachers, so far as I can obtain the requisite information; and shall, for an estimate of the comparative advantages of the old and new apparatus, refer to Berthollet, Rupp, Des Charmes, Parkes, and the article Bleaching, in the Edinburgh Encyclopedia.

The apparatus differs according to the sort of goods which are to be bleached; but I shall restrict myself here to an account of that used for linen, and heavy cotton goods; leaving such parts as are peculiar to the bleaching of wax, wool, silk, and paper, till I come to treat of the processes which are used for these substances.

As it is indispensable in good bleaching to have goods thoroughly washed at several stages of the process, and as to perform this manually would be both troublesome and expensive, particularly in works of great extent, several contrivances have been fallen upon for the ready performance of this operation on the large scale. The principal of which are the wash-stocks; and the dash-wheel and squeezers.

A machine, called the wash-stocks, is chiefly used in Scotland and Ireland. It is made on the same principle as the fulling mill, and differs from it but little. Two beams of wood are collaterally suspended by pivots upon a frame, so that they can move freely backwards and forwards. In the lower end of each beam, and almost at right angles with it, is mortised a piece of wood called the stock, which at one end is irregularly sloped. The cloth is put in a frame or box of wood, (elm is best,) into which runs a copious stream of water; and the stocks, with their sloped end inwards, play upon the cloth and gradually wash it. The cloth, during the process, is frequently turned, in consequence of being beat by the stocks against the end of the box containing it, which is of a round form. The stocks may be put in motion by a power from a steam-engine, or by a water-wheel, either with cranks or wipers, and ought to make from 20 to 30 strokes in the minute.[1] (Ramsay.)

The dash-wheel and squeezers are more recent contrivances for the same purpose, and are generally used in England and some parts of Scotland. The dash-wheel is a water-wheel, about six or seven feet in diameter, and two or three feet wide, which is closely boxed up all round. The inside is divided by wooden equi-distant partitions into four compartments, into each of which is a lateral opening through the frame work for introducing the cloth. There are also small holes for the purpose of admitting and draining off the water used in cleansing, from the goods. For the purpose of introducing the water, there is sometimes an open circle made laterally near the circumference of the wheel, into which a water pipe is made constantly to play. This circle is crossed with numerous wires, (which should be made of brass,) to prevent the escape of the cloth during the process. While the wheel revolves, the cloth is raised up in one part of the revolution, and by its own gravity it falls down in another; and an agitating motion is thus produced, which proves very effectual for washing the cloth, while at the same time it does not weaken nor injure its fabric. The dash-wheel ought to go at a velocity of about twenty revolutions in the minute, which is by much too quick to serve at the same time the purposes of a water-wheel; a strong objection where it is necessary to economise the disposable water. In the neighbourhood of London they do not make their dash-wheels with close frames, but of sparred work, upon which the water plays freely from a pipe terminating near the upper circumference, whose mouth is flattened so as to make the aperture wide and narrow. (Ramsay.)

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[1] It is amusing to hear Dr. Home say, with the utmost simplicity, that "nothing can be contrived so effectual to answer the purpose," as this machine. (P. 45.)

The squeezers, as they are called, form a necessary appendage to the dash-wheel. By these, the water is pressed out after the washing is completed. They are constructed with a pair of wooden rollers superimposed upon one another, between which the cloth is made to pass, and is by their pressure freed of its water. The lower roller receives its motion from a mill or steam-engine, and the upper is pressed down upon it by means of levers, in the construction of which the mill-wright will judiciously consult existing circumstances. The frame in which the rollers run, is neatest and most durable when made of cast iron. The rollers themselves should be made of elm, beach, or sycamore. (Ramsay.) A large press is sometimes used in place of squeezing rollers, and is a much more expeditious mode of management, but cannot act so equally as the rollers. (Parkes.)

The machine used for washing in France, and other parts of the continent, has more resemblance to the wash-stocks than to the dash-wheel. As in the former, a trough is constructed of elm for containing the goods, holes are made in it for the egress and regress of water, and rammers or pestles of beach, which pass through the upper part of the trough, are alternately raised and let down by tripping pieces fixed on a revolving shaft, and working in mortices made in the beams of the rammers. An ample description of this machine may be seen in Des Charmes.

For the steeping of goods after the first washing, a large circular vat is used, called a sieve; which may be made of almost any kind of wood; as, chesnut, oak, or fir. Oak has the advantage of not shrinking or contracting so soon as fir; but if fir be used on account of its cheapness, care must be taken to avoid using the white deal, which transmits water like a sponge, and to select the yellow in preference; as on account of the resin it contains, it undergoes less alteration in the fluid. If the use of white deal or other spongy wood cannot be avoided, it will be proper to paint the vessel within and without with several coatings of white lead. Melted pitch, tar, or a mixture of yellow wax and resin, may be also used with advantage for the purpose of coating. Care must be taken that the sieve have no cracks or splinters, which might endanger the tearing of goods in taking them out, because the fermentation causes them to expand and press against the sides of the vessels. Belonging to this are two pieces of wood made in the form of a cross, to lay over the goods while steeping. (Ramsay and Des Charmes.)

The goods are boiled in a common boiler, to which a stop-cock is fitted below, to run off the waste ley. Cast iron is what is generally used in the construction of these boilers; for which, the substitution of wrought iron, as in the case of the boilers of steam-engines, would not at all answer, because it is so liable to rust from its attraction for oxygen. The cast iron, on the other hand, always contains a portion of oxygen approaching to saturation, and consequently has its natural attraction for that substance greatly diminished. But it even requires particular management to fit the cast iron boilers for the purposes of boiling and bucking. For if *new* boilers are used, the action of the alkaline leys, by their attraction for the carbon of the cast iron, infallibly detaches a portion of the metal, effects a solution, and produces stains in the goods extremely difficult of removal. To remedy this inconvenience, the manufacturers *season* their cast iron boilers by boiling in them, for several days, a quantity of waste alkaline ley, by which process a thin crust is formed on the inside of the vessel, that in future prevents the immediate contact of the alkali with the carbonized iron. This crust or lamina is probably composed of a carbonate of the alkali which has been used, together with some of the impurities with which the ley may be charged. A similar process of seasoning cast iron vessels must be attended to when they are used in cookery. The boilers used in bleaching, are made to contain from 300 to 600 gallons of water, according to the extent of business. In order that their capacity may be enlarged, they are formed so as to admit a crib of wood strongly hooped, or, what is preferable, of cast iron, to be fixed to the upper extremity. For the purpose of keeping the goods from the bottom of the boiler, where the heat acts most forcibly, a strong iron ring covered with netting, made of stout rope, is allowed to rest six or eight inches above the bottom of the boiler. Four double ropes are attached to this ring for withdrawing the goods when sufficiently boiled, each of which has an eye for admitting hooks from the running tackle of a crane. Where more boilers than one are employed, the crane is so placed, that, in the range of its sweep, it may withdraw the goods from any of them. For this purpose, the crane turns on spindles at top and bottom; and the goods are raised or lowered at pleasure, by double pulleys and *shelves, by* means of a cylinder moved by cast iron wheels. The boiler should be fitted with a cover, well fitted both to economise heat, and to prevent the admission of soot or other impurities, which may produce stains difficult of removal. (Parkes. Ramsay. Des Charmes.)

The bucking apparatus is of considerable importance, and we have already mentioned the improvements of it which have lately been made; as their adoption, however, is not general, it may be necessary first to describe that commonly used. A wooden sieve, similar to that used for steeping, and fitted with a false bottom of wooden grate work, a few inches from the true bottom, to keep the goods from coming in contact with the cover of the boiler. Through this cover is a valve to regulate the transmission of the waste ley. There proceeds from the boiler through a short pipe slightly bent and placed in a horizontal direction, from the extremity of which arises a vertical pump, for the purpose of drawing the ley out of the boiler and pouring it on the goods. To effect this, a pipe similar to the one just described, runs horizontally from the pump to the sieve, where it throws the ley upon a cone of metal, which is supported by a bar of wood over the middle of the sieve, in order to diffuse the ley equally over the goods. The pump with its two pipes is not unlike the letter E, without its middle horizontal line; the sieve and boiler may be conceived to be placed in its bosom. This apparatus, which is the invention of Mr. John Lawrie of Glasgow, is certainly much more ingenious and convenient than that formerly used for this purpose; but it is greatly inferior in simplicity to that which I shall now describe.

I have not learned who invented the whale boiler, but it is an invention of great utility, and the principle upon which it is constructed is extremely simple and obvious. It consists, like that last mentioned, in a common cast iron boiler and a wooden sieve for containing the goods, but wants the pump, to work which, when the former is used, renders the process both tedious, laborious, and expensive. Within the sieve is fixed a false bottom perforated with holes, or made of spar work, for the ready transmission of the leys. From the middle of this bottom arises a pipe or flue, extending to the very top of the sieve, and in which, of course, the cold ley stands at the same level as in the boiler; but when it begins to boil, it immediately ascends through the flue with such force as even to rise above the brim of the sieve. Here it is stopped by a concave plate of sheet iron resembling an umbrella, which is suspended over the flue, and, striking against this, by the impulse of the ebullition, it is equally distributed over the surface of the goods at the top of the sieve. Aided by the temperature to which it has thus been brought, the ley gradually permeates the whole of the goods in the sieve, and, reaching the perforated bottom, repasses into the boiler, whence it is again thrown up into the flue, and follows the same routine as before. This process is continued till the goods are judged to be sufficiently bucked. The importance of this ingenious contrivance requires no comment from me; it is likely, I think, in a short time entirely to supersede the other. Des Charmes seems to have been very near the discovery of this contrivance; for, in describing his clumsy boiling apparatus, he says, (page 312,) that the boiler must be fitted with a cover held down by cramps to prevent its being raised by the force of the steam caused by the ebullition, which stream of hot ley is "by these means *compelled to re-act* on the goods in the boiler." (Parkes.)

IRRUPTION OF MOUNT VESUVIUS, IN THE YEAR 1819.

[Continued from page 287.]

With a tolerable share of shrugs and low-muttered curses, we again proceeded for nearly half an hour; scarcely a word being uttered by those who had previously been so troublesome with their vociferous gossip. There were a marked difference in the reduced size of the stones, and various fragments as we approached the crater—either they had been propelled more violently in proportion to their bulk, or the larger samples had descended lower, from their superior gravity.

The evening had been one of the most beauteous of beautiful Italy. The moon's full orb had shone resplendently; and as we were near to midsummer, it might have been said there had hardly been any night. We now stood upon the summit of Vesuvius. The mountain is nearly 4000 feet high, and appears in the distance to have a sister mountain close adjoining. Upon nearer observation, however, it should rather seem that this adjoining mountain, *Monte Somma*, was originally a part of Vesuvius, and separated by the falling in of the crater, probably at the great irruption in 79, when Pompeii was overwhelmed and destroyed: for the cone, on this side, appears exceedingly precipitous, while, on the other side, its slope is much more regular down to the sea. The base of the mountain is studded, on this side, with habitations:—here are the towns of *Torre del Annonciata*, *Torre del Greco*, and *Portici*, with their palaces and garden grounds. Within land, we observed *Somma*, *Massa*, *Ottacano*, and others of less note; so that, looking, with a bird's-eye view, over these parts, subject to all the most dreadful convulsions of nature, having fire and destruction occasionally revelling above and below them, with the further consciousness that beneath their own foundations lie the ruins of cities, once more populous and flourishing than their own—I could not help asking of what man was composed, that he should thus be induced to bid defiance to nature in her direst rage.

The crimson rays of morning were now lengthening along the heavens, and every moment gave us a yet more perfect view of the surrounding scenery. Here we had the delighting view of the *Campania Felice*—Naples and its promontories—its enchanting bay—its lovely islands, bounded by an immense sea, from which the attention was again quickly recalled, as with magnetic power, to the contemplation of those delicious regions which spread before us like a paradise, with the majestic Appenines as a semicircular boundary. This enchanting spot is surely, said I, the *chef-d'œuvre* of nature. Here is all the imagination can delight in. The heart, it is true, might sigh for a more moral population.

But to return to the mountain. For some time the heat, through our shoes, had become troublesome; we could now scarcely for an instant bear our feet upon the ground, it was so insufferably hot. Nor was this very surprising:—we were still some distance from the crater; and yet the incrustation upon which we stood was so thin, that several fissures we had already passed, and by which we were now surrounded, emitted heat and smoke enough to make it evident there was no great solidity of material beneath us. The sulphureous effluvia of these regions is excessively offensive; and I was just thinking how we should bear a closer approach to the crater, when our guides, palsied with fear, announced a new irruption.

Again, how terrible! All that is depicted of the thunderbolts and artillery of the great demon, of his boiling lakes of fire and brimstone, of his gulphs unquenchable; these, and a thousand horrors, assailed the mind at once, and forced on the stoutest observer feelings he could not before have known:—while our imaginations revelled—ay, rioted, amid beauty, grandeur, and sublimity!

I now perceived that we were safely within the range of the larger stones, and that they almost all fell beyond us; but we were not, in this irruption, therefore in less danger. A discharge of stones was now projected in nearly a horizontal line over our heads, from some new passage which the increased violence of this irruption had forced; and I must confess that the whizzing of these *mitrailles* very unceremoniously obtruded upon me some unwelcome doubts of safety. The lava flowed most copiously;—what effort of imagination could equal the magnificence of this sight! we seemed to inhale fire and fever from the very atmosphere we respired. The thrilling blood swelled my veins, and seemed convulsively endeavouring to burst through this weak mortal frame, and mix with the surrounding grandeur. In vain the mind made its usual efforts to contemplate and embrace the full sublimity of the scene. The attention was scarcely fixed upon any object, when it was snatched away to witness new phenomena.

Standing on this momentous brink, what an insignificant atom I presented, as compared to this rage of elements, and the tremendous perils everywhere surrounding me. I looked round to observe how my friends enjoyed their situation. They were—never shall I forget my terror and surprise—they were scattered far beneath me! But my alarm for my sister immediately subsided, when I perceived she was carefully supported by the same sturdy guardians under whose care I had placed her. This last discharge had destroyed any remnant of courage the guides possessed. The two leaders had seized each an arm, and hurried away with my sister; leaving me to my fate, for they had no hope of prevailing with me—and, indeed, no opportunity—in the *din* of these irruptions, no effort of human voice is distinguishable. Of all the party, the young Frenchman alone remained to bear me company.

The lava flowed down to the south of us: the guides, in retreating, had taken a northerly course. To proceed, we were, perhaps, running the risk of losing sight of them:—no matter; we confirmed our resolve to reach, at every risk, as nearly as possible, the source of this burning river, and again we "advanced together in our chivalry." What an astonishing fluid! composed principally of melted minerals; it is of the consistency of pitch, and seems to flow over itself, thickening as it descends. Even near the source, where it is more fluid, it presents an edge of several inches above the common level. I pressed my foot upon it to ascertain its density; and with the aid of a stone, detached a morsel from the stream. Sir W. Hamilton's extraordinary escape occurred to me. Having remained near the crater of Vesuvius, during an irruption, rather longer than was prudent, he found the stream of lava had spread itself so as to cut off his retreat. It was still copiously flowing—he had no alternative—he looked out for the part which, having most cooled, had become more dense, and, as lightly and as quickly as possible, he stepped across it—leaving the deep impression of every step!

With much reluctance, at length, we were obliged to turn from this extraordinary theatre of peril and of wonders, and proceeded to join our party. We found, as it is proverbially said, that cowardice is generally in most danger—for the guides had flown in terror from the spot where I had remained in range of the shot, by which two of them were slightly wounded.

The descent was on the leeward side, among the cinders. The rapidity of our progress was truly astonishing; with scarcely any effort, stepping only a trifle forward, we descended for a time, at each step, five or six feet, plunging nearly to our middle in heated damp ashes—a process disagreeable enough, and pregnant with more danger than at first appears; for, should some crag lurk beneath the surface, you are liable either to be severely bruised against it, or, according to its position, propelled unexpectedly forward; and, if you lose your equilibrium, dashed from rock to rock, until you meet your eternal resting-place. Care must, therefore, be taken to throw back the body, so as to be prepared for any shock. This route, with all this unpleasantness, is, however, far preferable, for the descent, to a return by the way which we ascended.

We at last alighted at the station where we had left our mules; and while these were getting ready, I had another opportunity of witnessing a shock of considerable violence. At this distance I had a more general view of the irruption. The combustibles emitted from the crater were at different regions obscured by the density of the smoke, and again seen rising in brightness above this dusky vale; and finally beheld spreading in their descent, like the falling waters of a fountain. How tranquil this scene compared with those in which I had lately been engaged! I could hardly take any interest in it—so much depends upon comparison, and the natural state of exhaustion consequent upon such immense previous excitement.

Upon commencing my descent among the ashes, I was not surprised to find, although they had just left the regions of fire and flame, they were quite damp. This fact will account satisfactorily for the phenomena of irruptions, and make their recurrence appear so arbitrary. The kingdom of this volcano extends itself, I have little doubt, under the city and bay of Naples; and the sea occasionally passing through fissures, flows into never-dying fires, and explodes through its crater in the altered form of gas, carrying with it whatever it may mix with, and detach from the interior of the volcano in its irresistible progress. This is the result of the inquiries I made of the guides; and which was confirmed too by the taste of the cinders, which I found had been manifestly wetted with salt water. Eustace also tells us of the mischief done to the surrounding towns and villages in the great irruption of 1794 by the cinders, and of "even water thrown from the mountain."

We soon reached the hermitage, and were received with all possible kindness. We partook, with no want of appetite, of a luxurious breakfast; and congratulated each other upon having safely passed one of the most extraordinary nights possible in the life of man. But my sister suddenly fell ill, and fainted. She had borne every difficulty, had braved every danger; the strong excitement of the occasion enabling her to overcome the ordinary feelings of nature, and to rise above the usual energies of her sex. But the same amount of spirit no longer required, she sunk under the dreadful reaction. Our host, the religious hermit, having studied medicine, quickly administered a reviving cordial; and after a few hours' rest she was well enough to be carried to her mule, and, being carefully supported, to proceed to the town of Torre del Greco. Here we again took coffee and refreshment; and my sister slowly recovered sufficient strength to enable us to set out for Naples.

LETTERS AND QUERIES.

GENTLEMEN,—It is very common to speak of persons having a bad ear, but the cause of this defect may not be so generally known. Buffon, in treating on the sense of hearing, says, "It often happens that people hear better with one ear than the other; and these, it is observed, have what musicians call a bad ear. I have made many trials on persons thus circumstanced, and have always found that their defect in judging properly of sounds, proceeds from the inequality of their ears, and their receiving by both at the same time unequal sensations. In like manner as such persons hear false, they also, without knowing it, sing false."

I am, yours, &c.

M. A.

1st June, 1825.

GENTLEMEN.—In No. LXX., page 191, M. B. requests to be informed of the best method of making shamoy leather adhere to the keys of musical instruments; he will find that sealing wax will do very well, by heating the key a little at the candle while melting the wax.

I am, yours, &c.

M. A.

GENTLEMEN,—If you, or any of your numerous and intelligent Correspondents, could inform me, through your medium, what are the best treatises on the following subjects:—Chemistry, Mathematics, Mechanics, and Geography, you will very much oblige some friends and I, as well as many of your readers, who are going to enter upon these studies.

I am, yours, &c.

J. B. H.

P. S. What is the best Pyrometer? What is the best test of good Madder? What is the best test of good Indigo? What advantages does the Mechanic, &c. derive from the study of Anatomy? What is the best mode of ascertaining whether seals which are shown as gold, are or are not such?

QUERIES.

1. By Mr. Barlow's correcting the compass, is the variation not to be ascertained without taking thirty-two observations, *viz.*—one from every point of the compass?

2. Does the invention only take away the effect of iron in the ship?

3. How is the effect of magnetic matter in land, or rocks, got clear of?

4. Does his plan give the variation that takes place betwixt the ship and the port, or place of destination; showing if it increases or decreases, and what quantity, in either case?

5. Is the attraction ascribed to the earth ascertained to be the same in every place, or more or less in different places?

Answers to these questions will perhaps help to lead to light, so as a corner of your Magazine will not be lost by having them inserted.

U. S. C.

1st June, 1825.

MISCELLANIES.

Natural History.—A reptile has been found in Manilla, of the family of the Agemoides, which has the faculty of changing colour like the camelion. When the reptile first came into the possession of M. Marion, who describes it, its colour, for twenty-four hours, was a delicate green, whether held in the dark or exposed to the sun. Next morning its colour throughout had changed to carmelite; when exposed to the air, this colour gradually disappeared, and the animal resumed its green robe. On this ground, certain brown lines were soon after visible; the animal afterwards, when excluded from the air, acquired a bluish green colour, and it was only in the open air that the brownish tints returned. At length the brown colour gave place to a uniform green, intermingled however with some brownish streaks. When laid on green or red substances, no grain of colour was observed.—*New York Com. Adv.*

Mahratta Villages.—Nothing can exceed the aspect of misery and desolation that prevails in the interior of most Mahratta villages. The streets are narrow, dirty, and unpaved. The houses are built of mud, and have flat roofs of the same material; and the lowness of their walls, combined with the small dimensions of the windows and doors, make them resemble cellars or dungeons. Some of these habitations are in the form of a hollow quadrangle, one side of which serves as a stable for horses and oxen, while the three others are occupied by a family. On looking into a house, one usually sees a solitary individual sitting unoccupied on the floor, with his eyes bent downwards. However, if it be evening, he may perhaps have a lamp beside him, and some cooking utensils, and his wife and children, or a few associates, as silent as himself. The bazaar is the only place where one sees any thing like mirth or sociality, the shops there bringing together a considerable number of people; some of whom come to purchase provisions, and others apparently to observe what is going on. The native shops are small sheds on each side of the street, furnished with shelves for the display of the different commodities sold in them, and lighted up at night with two or three lamps. The various sorts of grain are exposed in baskets, in the midst of which the merchant sits cross-legged, and patiently awaits the arrival of his customers, who make their purchases with the greatest caution, and usually not till after a vast deal of wrangling has taken place on both sides.—*Howison's Foreign Scenes.*

Indian Schools.—Among the Abenakes, a tribe of Indians of about 400, settled at the mouth of St. Francis River, is a school taught by an aged Indian; his name is T. Annace.—*Amer. S. S. Mag.*

Otaheitean Sailors.—A letter from Calcutta states, that a vessel trades between that port and New South Wales, which has on board sixteen Tahetian sailors, who are as attentive to their religious as to their temporal duties. Every night they assemble on deck and sing hymns in their native language.

Manchaneel Poison and its Antidote.—There is a tree called the Manchaneel, which grows in the West Indies; its appearance is very attractive, and the wood of it peculiarly beautiful; it bears a kind of apple resembling the golden pippen. This fruit looks very tempting, and smells very fragrant, but to eat of it is instant death, and its sap or juice is so poisonous, that if a few drops of it fall on the skin, it raises blisters and occasions great pain. The Indians dip their arrows in this juice, that they may poison their enemies when they wound them. Providence hath so appointed it, that one of these trees is never found, but near it there grows a white wood, or a fig tree, the juice of either of which, if applied in time, is a remedy for the diseases produced by the Manchaneel.

Origin of Coal Beds.—"The excavations along the Erie canal rout," says a Correspondent of the Daily Advertiser, "continue to bring to light new facts connected with the geology of the country. At Buffalo, considerable progress has already been made towards the completion of the canal to Black Rock, and I had the pleasure, the other day, of witnessing it in its most unfinished state. The land is low and moist, so that constant labour is necessary at the pumps to keep the water from impeding the workmen. I was surprised to see large pieces of wood thrown out of the ground, and soon discovered that the workmen had penetrated in a quarter of a mile through a moss formed entirely of trees and bushes, in various stages of preservation and decay. The sides of the canal were, for about that distance, entirely black, being composed of a singular substance resembling black mud when fresh, and afterwards exhibiting the fibre of wood in a half disorganized state. Logs, well preserved, are found scattered here and there, but the great mass resembles fossil coal at a little distance, and burns extremely well when thoroughly dried. I could not but think of the crushed forests which geologists have generally supposed to be the origin of coal beds, and I think many of them would be satisfied with the sight."—*New York Observer.*

London.—The magnitude of the metropolis cannot be fairly estimated without taking into consideration the extraordinary population of the villages in its vicinage. These are the branches of the trunk, and both are taken into account when we state the bulk of the tree. Persons who are only acquainted with country villages will startle when they hear of a village containing 18,262 inhabitants, which Chelsea does. Kensington contains 10,886; Hammersmith, 7,394; Brentford, new and old, 7,094; Fulham, 5,903; Wundsworth, 5,644; Richmond, 5,219; Clapham, 5,083. These villages are most of them of the size of large towns.

A woman in Ireland lately spun out of a pound of flax, seventy-seven hanks of yarn; one of which weighed only 74 grains, troy weight!

Asbestos.—Pliny mentions having seen napkins of cloth made of asbestos; which being taken from the table after a feast, were thrown into the fire, and by that means were better cleansed than if they had been washed in water; but its principal use, according to that author, was for making shrouds for royal funerals, to wrap up the corpse, so that the human ashes might be preserved distinct from those of the wood.

Life at Sea.—At sea, people usually are in the best spirits when the wind is favourable, and when the ship moves pretty rapidly through the waters. Indeed it appears, that, under almost any circumstances, the mere act of progressing excites the animal activity, and exhilarates the mind. Dr. Johnson says that life affords few pleasures greater than that of being whirled along in a post chaise; and what horseman has not felt the inspiring influence of a rapid gallop? The sensation of dashing through the billows at the rate of ten or eleven miles an hour, is one which is very delightful, and which irresistably disposes people to be in good humour with each other. At such times every thing has an animated appearance. The sea becomes brilliantly blue, and swells and wreaths the crests of its billows into a thousand different shapes; while vast semicircles of foam, dazzling white, diverge from the bows of the vessel in rapid succession; and a long train of diminishing brightness, like a milky-way, undulates in the course of her wake, as far as the eye can reach. Birds flutter round her stern, and keep pace with her with unremitting wing; porpoises perhaps gambol on every side, sometimes springing out of the water, sometimes rapidly skimming along its surface, and sometimes darting downwards and emitting a flash of light at the moment they disappear. The wind whistles gaily among the shrouds, the seamen hurry about aloft, and the ample distended sails swell their bosoms, in the sunshine, and triumphantly receive those breezes which give the ship a temporary sovereignty over the surrounding ocean. The passengers now assemble on deck in high spirits; those unhappy sufferers who have been confined to bed for weeks, are brought up the gangway in arm chairs. The captain congratulates them upon the favourable weather; the helmsman looks knowingly, and steers with judgment; and the officer of the watch, on heaving the log, throws it from him with an air of complacency and satisfaction, and having drawn in the line, calls out "Eleven and a half, Sir;" "Very well," returns the captain, "keep her at that." The party then descend to the dinner table, the wine circulates freely, calculations are made when the ship will reach her destination, and bets are taken upon the question, and the universal gaiety that prevails almost puts one for a little time in good humour with "Life at Sea."—*Howison's Foreign Scenes.*

American Taste.—In an account contained in the New York Observer, of a dinner given in this city to General La' Fayette, we have the following among the decorations. "One of the most interesting devices was a miniature representation of the Grand Canal, seventy feet in length, and running through the middle of the table, which had been made of double the usual width for that purpose. The canal was filled with water, and on its bosom were miniature canal boats, flocks of water fowl, &c. The banks of the canal were formed of beautiful green sward, two feet wide, cut and fitted with the utmost exactness, and ornamented with groves of trees, variegated with flower gardens, and occasional tufts of blossoms, &c. Looking at this representation from the head of the table, the effect was indescribably fine. You saw, as it were, a long line of canal running through green pastures and meadows; now winding its way through ledges of rocks, (placed there for the purpose,) and now running at the foot of a gentle hill; now passing under a bridge, and now lost in the midst of a little forest, or behind a miniature mountain. This representation of one of the great sources of wealth, and prosperity, and enterprise of the state, was much admired for its taste and neatness, and, it is said, was got up under the direction of a person formerly in the employment of the king of Naples."

Curious Discovery.—Mr. Falun has lately witnessed an incident which partakes of the romantic. In opening a communication between two mines, the corpse of a miner was found, completely preserved, and in a state of softness, being impregnated with the vitriolic water of the mine. When exposed to the air it became stiff. The features were not recognised by any person present; but tradition had prolonged the recollection of the accident by which he had been involved in the bowels of the earth, more than half a century ago. All further enquiry was dropped, when suddenly a decrepit old woman, leaning on her crutches, advanced, and discovered that the party was a young man to whom she had been engaged by promise of marriage fifty years before. She threw herself on the body of her former lover, and bedewed it with many tears; fainting with joy to have again beheld the object of affection before she descended to the tomb! The contrast between these parties, one of them buried during fifty years, yet preserving all the features; of the other, bending beneath the load of years, and living, if she could be said to live, during an equal space of time above ground, may be more easily conceived than described.

Scriptural allusion explained.—In page 50 of the Annotations upon Glanvill's Lux Orientalis, the author (who was, I believe, Henry More, the Platonist) having occasion to quote from the Psalms—"The sun shall not burn thee by day, neither shall the moon by night," in order to illustrate that class of cases where an ellipsis is to be suggested by the sense rather than directly indicated, says, "the word *burn* cannot be repeated, but some other more suitable verb is to be supplied." A gentleman, however, who has lately returned from Upper Egypt, &c., assured me that the moon does produce an effect on the skin, which may as accurately be expressed by the word "burn" as any solar effect. By sleeping a few hours under the light of a full moon, which is as much shunned in some parts of the East, as sleeping on the wet ground with us, or standing bareheaded under the noon-day sun in Bengal, my informant brought a severe complaint upon his eyes.—*London Magazine.*

USEFUL RECEIPTS.

A Fire and Waterproof Cement. — To half a pint of milk put an equal quantity of vinegar, in order to thicken, or curdle it; then separate the curd from the whey, and mix the whey with the whites of four or five eggs, beating the whole well together. When it is well mixed, add a little quick lime, through a sieve, until it has become a thick paste. This is the cement. It dries quickly, and will resist the action of fire and water.

C. D.

Springbank, 3d June, 1825.

To protect Wood from Worms.—Take walnut shells and macerate them in water, to which add a small quantity of alum, and boil the mixture for a short space; then strain it. When cold, rub it lightly over every part of the wood to be preserved, and after it is dry, rub it well with a small quantity of hog's lard.

To make an excellent Durable Ink.—Mix together in a quart wine measure of cold spring water, 2 ounces of Aleppo galls bruised, 1 ounce of green copperas, and 1 ounce of gum arabic, and shake them twice a day for ten days, when it will be fit for use. This ink writes pale, but becomes black on drying.

To make Brandy from Scotch Whisky.—Take florentine orris root, bruised, 2 ounces; raisins, bruised, 4 ounces; sweet spirit of nitre, $\frac{1}{4}$ ounce; and one gallon of good whisky, free from the flavour of the peat reek. Shake the mixture two or three times daily, and after seven days, filter it through blotting paper, or shamoy leather. The common grain whisky may do very well, if the flavour is corrected by any one of the alkalies. To give it the brandy colour, take a small quantity of the extract of logwood, a little burnt sugar, or perhaps a mixture of both will make a finer colour.

NOTICES TO CORRESPONDENTS.

S. D. Liverpool, is informed that the Chimney Cans he proposes as an improvement, or some very similar to them, have been long very generally used here. W. C.—Fuscus—A. K. J.—L. M., &c. have been received.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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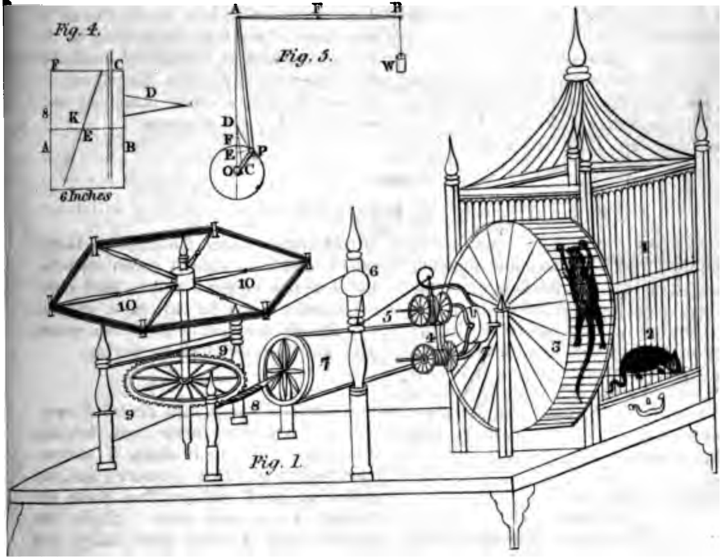
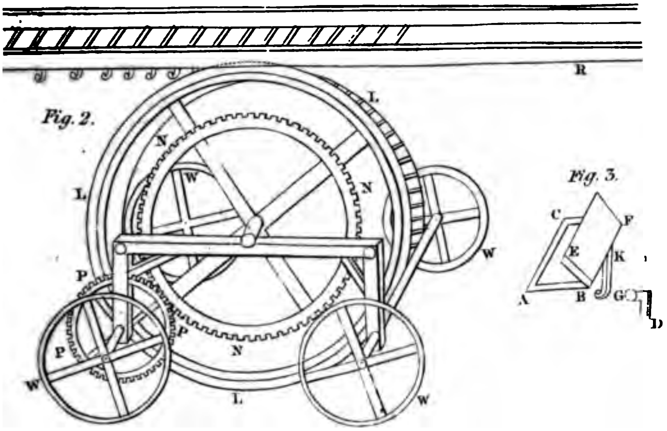
"Read not to contradict or confute; nor to believe and take for granted; nor to find talk and discourse; but to weigh and consider."

No. LXXVIII. *Saturday,* 18*th* *June,* 1825. Price 3*d.*

FRIEND HATTON'S MOUSE THREAD MILL; LOCOMOTIVE WATER-WHEEL; &c.





Swan Sc

FRIEND HATTON'S MOUSE THREAD MILL.

Respected Friends,—Here thou and thy numerous readers have a fair representation of my Mouse Thread Mill; (see fig. 1.) In the summer of the year 1812, I had occasion to be in Perth; and when inspecting the toys and trinkets that were manufactured by the French prisoners in the depot there, my attention was involuntarily attracted by a little toy-house with a wheel in the gabel of it, that was running rapidly round, impelled by the insignificant gravity of a *common house mouse*. For one shilling I purchased house, mouse, and wheel. Inclosed in a handkerchief in my journey homewards, I was compelled to contemplate its favourite amusement.

> "Some place their bliss in action, some in ease."

The mouse places it undoubtedly in action, thought I, or it would never run in this manner without compulsion. "Knowledge is power," says friend Bacon; and so it is with regard to mice as well as when applied to those two potent elements, fire and water. But how to apply a half-ounce power (which is the weight of a mouse) to a useful purpose, was the difficulty. The time in travelling 27 miles from Perth to Dunfermline, was unweariedly employed. I was mentally intoxicated; for schemers, like poets, are often intoxicated; and this intoxication forms the principal reward of all their toils. Many plans were for a moment adopted, and as quickly thrown into the shade; at length, the manufacturing of sewing thread appeared the most practicable. Two or three methods were successively tried, which had all to be abandoned. The present plan has exceeded my most sanguine expectations; its simplicity, as may be seen by the plate, makes it require little illustration. In this age of improvement, there is no saying but the smallest quadruped, the *mouse*, may yet exceed, in usefulness to man, the largest of all four-footed animals, the *elephant*. Anticipating the time when the labour of the mouse may be necessary for extensive thread manufactories, I shall show thy readers the easiest method of catching these useful animals alive. Take one of those box-traps which has an inclined lifter at both ends; turn it upside down; put oat-meal and water into it. The trap, when lying in this manner, allows the mice free ingress and egress. Let the trap lye in this position for three or four days; turn it up; and, as they know no difference, the trap will immediately be filled with a great variety of healthy, happy, and the most industrious of all the brute creation.

In the Glasgow Journal, I saw a paragraph the other day, but that friend was mistaken in one point; he said, "the mouse ran actively from its ineffectual efforts to escape." I assure thee, however, that I have often placed the meal and water a whole yard from the wheel, with the house door standing open; and it came out to its victuals, and ran as often into its work, and would have done so for two or three weeks, until the cat, or some other accident, forced it to desert its master and its favourite amusement. I had a wheel which moved simply on an axle, without any house attached to it. I put this wheel into a press, and placed meal and water at a little distance, the press being always dark; when they came for food, they jumped into the wheel, and, with dextrous alacrity, made the wheel revolve almost day and night; for the mice in that press were not deficient in number, they would have required a few of Malthus's checks to have kept them within due bounds.

I will, for a moment, draw thy attention to another singularity with regard to these animals, that demonstratively proves that their running propensity requires no excitement; and I question if any thing similar to it can be produced in all the arcana of animated nature. In the course of three years, I have had four female mice that brought forth, the one, five; two other, six each; the last, seven young ones; and they invariably, immediately after their brood were deposited in the nest, commenced running, neglecting their offspring, so that they all perished. Here female parental affection, the strongest of all animal instincts, was completely extinguished. Now, my very much respected friends, I assure thee that there is no more cruelty in employing mice to manufacture thread, than in erecting a mill to be moved by the almost omnipotent power of the steam engine; the power of which, compared to a mouse power, I shall make apparent by the following calculation:—I had one mouse that ran the amazing distance of 18 miles a day; but I have proved to a certainty, that an ordinary mouse runs 10½ miles at an average; and a halfpenny worth of oat-meal is sufficient for its support for 35 days, during which it runs 735 half miles. Now, suppose a steam engine of only one half ounce power, with a piston rod 735 half miles in length, it is evident that one stroke of such an engine would just cost a halfpenny. A steam engine of 12 inches diameter atmospheric power, has a force equal to 36,288 half ounces; let this engine have 18 inches of a stroke; in 735 half miles, there is 1,293,600 half yards; divide this by 36,288, the number of half ounces in the engine's power, and we have 35½ strokes nearly; so that a halfpenny spent on mouse power, is equal to 35½ strokes of a twelve inch diameter engine. If any of thy ingenious correspondents would state the expense of 35½ strokes of such an engine, we would then see what difference in expense there is betwixt the power of mice and that of steam.

That thou and thy numerous, enlightened, and ingenious correspondents, may continue to make thy Magazine "loved at home" and "revered abroad;" and that we, the people of Scotland, who are unquestionably the most moral among the nations, may continue to lift *our heads on high,* and be to them a pattern of intelligence, as well as of good works, is the fervent wish of thy contributor,

Friend HATTON.

Dunfermline,
3d day, 6th Month, 1825.

Explanation of the Plate.

1, the house or cage where the mouse receives its food, and rests from its labour. 2, the mouse, partaking of Scotland's wholesome aliment, oat-meal and water. 3, the mouse, employed at work, running at an angle to the centre of gravity of 90 degrees. 4, the two bobins of yarn of which the thread is manufactured. 5, a glass eye in the pillar where the two threads are united. 6, a small pulley to conduct the thread straight on the reel. 7, two wheels, (the one large, the other small,) over which the band goes that drives the reel. 8, an endless screw, that drives a seventy toothed wheel. 9, the seventy toothed wheel, on the shaft of which the reel is fixed. 10, the reel, on which the thread is wound ready for the market.

LOCOMOTIVE WATER-WHEEL.

GENTLEMEN,—Among all the inventions of the present day, it is surprising that water has never been thought of as a moving power for producing progressive motion. The following plan might perhaps succeed, where circumstances allow its application.

W, W, W, W, (fig 2.) are the wheels that move upon the rail-way. P, P, P, is a teethed wheel upon the axis of W, and is put in motion by the teethed wheel N, N, N, upon the axis of the water-wheel L, L, L. The axis of the water-wheel rests on a beam O, O, which is supported on the axles of the wheels W, W. R, R, is a wooden canal, erected above the rail-way, to contain the water which moves the wheel. There are valves in the bottom of the canal, which are opened by means of an arm K, G, (fig. 3,) which is moved by an upright piece of wood G, D, fixed to the beam O, O.

The opening of the valves, one of which is represented in fig. 3, will expend only a small portion of the power; for no sooner is the valve raised in the smallest degree, than the water rushes out, and the pressure on the valve, when opening, becomes very trifling, especially if the valve be shorter than the breadth of the canal.

It is evident, that there are few situations naturally adapted to this machine; but where it can be employed, after erecting the canal and machinery, the expense afterwards would be comparatively nothing; whereas the steam-engine occasions a constant expense, from its continual consumption of fuel.

I am, yours, &c.

A. B.

Dollar, 23d May, 1825.

CHEAP BLOWPIPE.

IT appears to me, that every invention which has for its object the advancement of knowledge or furtherance of art, and which can be of the least service to mechanics, unquestionably claims a place for insertion in your weekly Magazine.

For the benefit of those, therefore, who may stand in need of a blowpipe, it falls to my lot to point out the advantages of one which I have invented, and which I will briefly mention; time and experience will show its disadvantages and the improvements it is capable of.

1st, Its smallness; as the one in my possession stands only 8 inches high, 6 long, and 4 wide; and will continue, when once filled with air, to blow for half a minute. 2d, Cheapness; as it cost only one shilling. 3d, Force; equal to three broaded bellows. And lastly, it can be removed from one part to another with the greatest facility.

The plate (fig. 4,) contains a figure of the instrument.

A, B, is the vessel, made of tinned iron; C, the pipe, that goes to within one inch of the bottom of the vessel, and is the one for filling it with air; D, the blowpipe, which stands three inches from the top; E, a partition, which runs in an oblique direction, and approaches to within half an inch of the bottom; F, the only part that is uncovered; the dotted line, K, is the surface of the water, which should half fill the vessel.

The manner of working, is as follows:—You blow into the pipe, C, and the air rises above the water, and presses upon its surface, and the internal surface of the vessel; and the water rises in the opposite side of the oblique partition; and as the inferior end of the pipe is in the water, the water acts as a valve to the air in the vessel; the pipe C, being larger than the blowpipe D, the vessel is sooner filled than emptied, in the proportion of their size.

Artizans who are in the practice of blowing glass eyes for birds, bulbs for thermometers, soldering, &c. &c. by means of the blowpipe, will find it an instrument well adopted for the art.—Yours, &c.

FUSCUS.

Kilwinning, 6th June, 1825.

ON THE CRANK.

GENTLEMEN,—In No. LXXIII. I observe that G. M. has thrown out some animadversions in rather a cavalier-like style, which does not appear to be worthy of imitation.

He appears to be unwilling to grant me the merit even of proving that I was mistaken. This is certainly very hard. And yet, not contented with having done the same himself, he must remind us of it again, (apparently lest we should forget it,) and says, "I have refuted," &c. But neither G. M. nor A. B. have any great merit to claim in this respect, after the information afforded by W. C. He speaks too of a "singular process;" but he will certainly perceive, on a second thought, that a weight, suspended on a point of the circumference of the circle alluded to, loses just as much of its pressure in reference to an equal weight on the opposite circumference, in the same horizontal line with the centre, as it would lose of its weight if placed upon a plane perpendicular to the plane of the circle, and passing through the tangent at the point where the weight is applied. He employs a sort of syllogistic legerdemain in one of his sentences, which implicitly goes to prove, that if a problem be solved inaccurately, yet if the solver does not perceive the inaccuracy, he is not chargeable with it. He finishes with a remark that would lead any person, who had not read the preceding Numbers of the Magazine, to suppose that I had advanced, as my own, the invention suggested by another. If this misrepresentation has arisen from inadvertency, and I hope it is the case, it might be easily forgiven. Besides, a mechanic may be *intelligent,* although he be ignorant of the true theory of a water-wheel; he could adopt the opinion of another, without thinking or doubting much about it. With respect to the sweep of the crank not being equal to the stroke of the piston, I ought to have mentioned that it is in the case of a beam, with the fulcrum at its middle point, and a segment on its extremity next the piston. But, in this case, it would appear, that while the mechanical advantage at the extremity next the piston remains the same, that at the other extremity is variable; and if the calculation were made, it would likely be found, that this circumstance would compensate for the diminution of its success. I am not certain if this construction be employed in the case of the steam engine, but I believe it is used in working pumps.

I had entered on the consideration of the crank with prejudices against it, and supposed it to be pretty generally admitted, that there was at least some loss occasioned by its use, however much opinions might differ as to the quantity; and considered, that the conclusion to be arrived at ought necessarily to be unfavourable to the crank. The reasoning, so far as it went, was correct; but the conclusion was wrong, as there was still another argument to be supplied. This deficiency was easily supplied after W. C. showed the true conclusion; but G. M. pointed out the general principle that had been overlooked; although there are various ways by which the true conclusion may be proved.

It would still appear, however, from the following consideration; that there is some loss of power in some of its applications.

Let O P, (fig. 5,) be the position of the crank, and P A the rod connecting it to the beam A B, whose fulcrum is F; W, a weight to be raised; D P, a tangent at P; D C parallel to A P; P E perpendicular to O F. Then, when the water is the moving power, its power is always exerted at any point P, in the direction of the tangent D P; and the weight W acts in the direction P A, and when these are in equilibrium, if $P =$ the power, $P : W = PD : DC$; but angles D P C and P E O are right angles, and angles D C P and P O E differ only by the small angle O A P, which in practice is smaller than in the figure; and if it be neglected, triangles C P D and O P E are sensibly similar; and $PD : DC = EP : PO$; and if arc $FP = a$, $P : W = EP : PO = \text{sine } a : \text{radius}$; or, $W = \dfrac{P \times \text{radius}}{\text{sine } a} = \dfrac{P}{\text{radius}} \times \text{cosecant } a$; and the power P being constant, W is proportional to cosecant a. But when a is small, cos. a is great, but the weight W is constant; hence the power, in such a position, will far exceed the weight; and to produce a uniform circular motion, the power and weight should have a constant ratio. But as, in the above case, the power bears a less and less ratio to the weight as the arc a increases, the circular motion must be very irregular, and therefore the velocity of the water-wheel must vary. Yet as it must have a a certain velocity to produce the greatest work possible, the above irregular motion must diminish its momentum, and occasion a loss of power. If the machinery, however, be massy, a very slight increase of motion would increase its momentum of rotation considerably, which would again be given out when the crank is in its unfavourable position. If a fly-wheel be used, the same thing would take place; but when no fly is used, and when the machinery is light, a sensible irregularity of motion must take place. The velocity with which steam expands, is so very great, that, unless the velocity of the piston bear a considerable proportion to it, a circumstance not likely to happen, there would be no sensible loss of power.—I am, yours, &c.

A. B.

Dollar, 31st May, 1825.

MODE OF HARDENING STUCCO BUSTS.

GENTLEMEN,—Having often amused myself, during a leisure hour, in making casts in stucco, sulphur, and glass, I hasten to communicate, for the information of your correspondent A. R., and others similarly occupied, the method which I adopt in finishing the surface of those done in stucco.

When the stucco is wished to be only moderately hard, then I have found the following to be the best plan: after the bust or model has been made in the usual way, it

d be dried very slowly, but
ughly, in a well aired room,
ut employing heat; when dry,
irface should be sponged over
newly skimmed milk, and it
d then be again allowed to dry
y. The casts may be, in this
sponged three, four, or even
imes with the skimmed milk,
ding to the body of stucco
ı they contain, or till they
y the taste or object of the
tor. During the process of
g, the casts should be covered
sheets of paper, to prevent the
collecting upon them; or, if
are models, they may be sup-
d in an inverted position.
his sponging, the stucco ac-
s a shining appearance, and is
iently hard to admit of its
dusted. After a stucco sur-
has been thus prepared, we
cast from it impressions in
o and sulphur, provided we
the usual precaution of coming over the face of the mould with olive oil, or a weak solution of soap.

When A. R. wishes the bust harder than I have described above, then he should proceed in the same way, substituting a very weak solution of fine glue for the skim milk.

Another very good method for hardening the surface, either of a mould or a cast, is to give it several coatings of lintseed oil which has been well boiled; and to give a better colour to the stucco, than the oil by itself generally does, I previously tinge the oil of a rich red, by boiling in it some bruised Alkanet root, *(Radix Anchusæ Tinctoriæ,)* tied in a linen bag.

Hoping this will prove satisfactory to your Querist,

I remain, yours, &c.
JOHN DEUCHAR.

Dalkeith School of Arts,
4th June, 1825.

LIVERPOOL MECHANICS' INSTITUTE.

ıs often been matter of sur-
that in a town of such wealth
verpool, and where there un-
edly is so much liberality and
gence, there never should hith-
ave been a Mechanics' Institute.
with pleasure, therefore, we
n our readers, that a meeting
ixed for Wednesday last, at
ı the mechanics and artizans
e town were requested to at-
for the purpose of originating

wonder, however, it has been
ıg of being done, for it would
ır that there is still a desire to
bstacles in the way, by a cer-
ortion of those in authority.
bserve from an article in that
lent paper, the Liverpool Mer-
that the Mayor has declined
ing the meeting to take place in the Town Hall, although he had been requested to do so, by a requisition signed two months ago, by a great number of persons of all parties; and more particularly by the master tradesmen, and the heads of the manufacturing establishments of Liverpool. We truly believed that the day for this petty opposition to the advancement and instruction of the working classes was gone by; and we are sorry, very sorry, to find ourselves partially mistaken. It would appear that among certain individuals, (limited in number, we hope,) there still is a desire to keep mankind in ignorance. We have no intention of lecturing these men; our work is not for them, and in all probability they will never see it. For us, therefore, to enter now upon such

a discussion, would only be writing to those who are already convinced; because none, we suspect, who are not advocates for the education of mechanics, will trouble themselves reading the Glasgow Mechanics' Magazine.

Instead of this little obstacle being any real barrier in the way, we are certain, as is always the result in such cases, it will tend to promote that which it is intended to crush. With such patronage as that of Mr. Huskisson; and the co-operation of such a m Mr. E. Smith, the enlightened energetic Editor of the Mer there is little to fear; and we no doubt that very shortly we be enabled, through the medi some of our Liverpool friend present our readers with an ac of the proceedings, and the mencement of a Liverpool chanics' Institution.

ESSAYS ON BLEACHING,

By James Rennie, A. M. Lecturer on Philosophy, &c. &c., London.

No. II.—BLEACHING APPARATUS.

SECTION II.

The apparatus for preparing the different combinations of chlorine with the alkalies, with lime, or with water, has also been somewhat improved since its first invention by Berthollet, but this has only been the case in the materials used for its construction, and in some of its less important parts: the principles on which it is now made, are the same as in the earliest periods of its employment. Mr. Rupp, (Manchester Memoirs, V. p. 301, in a note,) complains of Berthollet's apparatus as too complex for a manufactory, and recommends a range of four, five, or six hogsheads or rum puncheons, connected with one another in the manner of Woulfe's apparatus, as being greatly preferable. It will be recollected that this is exactly the method which was resorted to by the Aberdeen bleachers, when they found it inconvenient to use glass. (See page 280, No. LXXVI.)

The one now commonly used is said by Ramsay to have been contrived by Mr. Fisher of Rutherglen; that which I shall now describe as the best which has come *to my knowledge*, is somewhat different from Mr. Fisher's, a scribed by Ramsay, and is that by the most enlightened bleach England and Ireland. Over nace, constructed in the usual is placed a cast iron vessel co ing water, which forms a bath for the reception of a This still, into which is pu materials for furnishing chlori made of lead, and properly ada both in form and size, to the iron water bath in which it st The top of the still is furn with water lutes, to keep the ratus tight and prevent the gas escaping. These lutes are made of loose flax, dipped in lead, which has been ground i The head of the still is also of and sufficiently large to allow dipping six inches into the gutt water which surrounds the bo the still; whence it can be take or put on at pleasure. In the t made a circular hole of three in diameter, to introduce the ma als, and occasionally to clean the still. The hole is fitted w plug of lead, which is gently st into the cover when the appa is arranged for working, an luted with soft clay to preven escape of gas. To agitate the materials, there is fixed in the still a *stirrer*, consisting of a square frame of wood covered with lead. From the still there runs a bent tube to convey the gas to the receiver for the alkaline solutions. But before it is admitted into this, it passes into a small circular vessel, which is, according to the proportion of the apparatus, from twelve to eighteen inches diameter, and contains water in order to arrest any uncombined chlorine which may arise in the process; but since the water bath has been substituted for the sand bath, this seldom occurs. The gas is then admitted into a large receiver, charged with the alkaline, or calcareous solution, intended to receive and absorb the chlorine gas which comes from the still, and when sufficiently saturated it is drawn off by a brass cock fixed at about two inches from the bottom of the receiver. The receiver is of a square form, or that of an inverted cone, and is made of lead, where the capacity does not exceed 120 gallons, and of wood lined with lead, when the business is extensive. It is closely covered at top, and has a hole for introducing water into the receiver with a leaden plug. In some manufactories, two or three false bottoms made of lead are laid on brackets of the same metal fixed to the side of the receiver. These false bottoms are perforated, or made of spar work, in order to spread the chlorine through the water during distillation. The solution is constantly stirred, to promote the absorption of the gas, by an agitator, which, in large works, is driven by a power from a steam engine. (Parkes. Ramsay.)

In recovering alkali from waste leys, it is found more economical to construct what are called stone boilers, than to employ vessels *either of lead or iron*. Stone boilers are large oblong chambers, whose lateral walls are about two feet high, and are built into the ground to prevent their giving way. The outside wall is well rammed with tempered clay puddle to prevent leakage. An arch of brick is thrown over between the walls, which is covered with mortar to retain the heat. Proper openings are at the same time left, by which to examine the state of the liquid; these are covered with a plate of iron. At one end of the chamber, a furnace of a sufficient capacity is built, having a breast work interposed between it and the liquid, over which the flame plays. At the other end of the chamber, a vent of sufficient height is built to carry off the smoke. The fire being lighted, the flame plays along the surface of the liquid, which by this means is evaporated. Some of these stone boilers are so capacious as to contain 10,000 gallons. (Ramsay.)

When stone boilers are not used, common evaporating pans may be employed, and particularly in works of moderate extent. After the leys have been brought to a due consistence, the materials are removed to a small reverberatory furnace and gently calcined. A common baker's oven is well adapted for this purpose, and is used, as we learn from Des Charmes, (p. 87,) in the manufactories in France. If the former is preferred, the process should, if possible, be continued night and day; or, at least, the fires should be raked up at night, and the passages of the chimnies carefully stopped. Furnaces which are thus wrought, will last seven times as long as those where it is not attended to; insomuch as the contraction of the materials, during the time of cooling, and their subsequent expansion, wear them rapidly out. (Parkes.)

To avoid the inconvenience and

injury arising from the escape of the noxious vapours of chlorine from the bleaching liquors, and to have the goods more equally exposed than in the old mode of stratifying them above one another in large vessels, Mr. Rupp of Manchester contrived an apparatus extremely simple and ingenious. It consists of an oblong deal cistern, made water tight, with two perpendicular beams, made to turn round on their axes, and each furnished at the lower end with a plain pulley of a large diameter. On one of these beams the cloth is rolled after the pieces are slightly sewed together. The cistern is filled with the bleaching liquor, and the cloth is wound by means of a winch from one beam to another several times successively, so as to expose the whole of its surface equally to the fluid.

I shall conclude this part of my subject with a few practical notices, which are of importance to be attended to in conducting extensive bleaching manufactories.

1. When boilers are set in brick work, care should be taken not to make the fire places too large, for when the bars are not entirely covered with fuel, the cold air rushes in from the ash pit, between the uncovered bars, and counteracts the effects of the heat. Fire places should be no larger than is barely necessary for fuel to produce the intended effect. They should be so constructed also, that the whole bottom of the boiler be exposed to the action of the burning fuel, and that the whole of the flame and heated air actually impinge upon the bottom before they reach the sides to pass to the chimney; for the heat applied to the bottom will be infinitely more effective than that applied to the sides. To aid this, some large stills and coppers are made with the bottom to project inwards, presenting a concave surface to the flame; some have, for the same purpose, a flue of 10 or 30 inches diameter running through them. (Parkes.)

2. As cast iron is so liable to break from its unequal expansion when submitted to heat, steam engine boilers are now usually made at a great expense, with plates of wrought iron rivetted together, which, in the end, come to be cheaper, from their greater durability. But much expense might be saved by making the *upper* part of cast iron, as it does not suffer from the action of fire. This might be done by screws, and when the old bottom was worn out, it could be removed and a new one put in its place. The vessel would then be as good as at first. (Parkes.)

3. In works where large and expensive iron boilers are used, sulphurous coals ought to be avoided if possible, as the sulphur rises during combustion, unites with the iron of the boiler, and forms a sulphuret of that metal, which wastes away as fast as it is formed, and soon renders the boiler totally useless. (Parkes.)

4. In places where peat is to be had, it is an economical fuel in manufactories. In some places of Scotland, we are told by Mr. Mushet, (Phil. Mag. VII. p. 44,) that it can easily be procured at a shilling per ton, and four tons of dried peat, as he distinctly shows, will make something more than one ton of peat char, a substance which produces a much stronger fire than coals or coke. M. Sage informs us, that he found, by repeated experiments, that the turf char produces a heat nearly in the proportion of 3 to 1 of the best charcoal. But while we can say this much, we must not conceal that it is not easy to make peat char, as it requires a peculiarity of management

which can only be acquired by considerable experience.[1] (Parkes.)

5. A great deal of the sheet lead in the market is manufactured from old lead, and, consequently, contains solder and other impurities. Such lead ought carefully to be avoided in the construction of retorts and chambers; for a small portion of tin or plumber's solder will reduce the melting point of the metal very considerably. Lead, for example, melts at 612° Fah. but with $\frac{1}{25}$ of tin, the melting point is at 558°; with $\frac{1}{14}$, at 555°; and with $\frac{1}{9}$, at 530°. Upon the same principles, Des Charmes cautions the manufacturer against joining any of his lead vessels by soldering, and recommends the fusing of the parts to be joined, as preferable; " for," says he, " in process of time the solder, though ever so strong, yet because it contains tin, is liable to excessive corrosion by chlorine, which is not found to attack lead, even when heated in any sensible degree." But if it cannot be managed without solder, the parts soldered must be defended by several coats of white lead, putty, resin, or pitch mixed with bee's wax, any of which experience proves to effectually answer the end. Lead is sometimes used for lining or securing parts of the kier which are thought to be in danger of leaking. Now, the sulphur which is always contained more or less in potash, acts upon lead, forms a sulphuret, which being of a red colour, is liable to produce stains. (Parkes.)

6. I shall here mention a circumstance which, although it may seem trivial, is of some importance; namely, that in the roofs of bucking houses there should not, as there sometimes is, be any iron nails; for the steam from the boiling vessels will be condensed by the tiles, and the water thence arising will wash off from the nails the oxide which it contributes to form, and this falling on the cloth will produce stains, of whose origin the workmen may often be at a loss to discover the cause. No iron ought to be used in the roof of a bleaching house, nor any lime on the inner side of the walls. (Parkes.)

7. As some of the vessels in the bleaching process may, when fuel is scarce, be heated by steam, and as in every case dryers and other parts of the apparatus are actually so heated, it will be useful to mention, that as charcoal is a very slow conductor of caloric, in proportion to dry sand as 3 to 2, all those vessels which are heated by steam, if they were made double, and the space between the outer and the inner vessel filled with ground charcoal, the heat would be so prevented from escaping, and any one particular temperature might be kept up for a great length of time, and make a material saving in fuel. (Parkes.)

8. Since the adoption of the dry oxymuriate of lime, the distilling apparatus is less used than formerly, as the bleachers buy this salt ready prepared. It is still used, however, in making oxymuriates of the alkalies. In this process, it is of the utmost importance to attend to careful luting; so much so, that Des Charmes affirms, (page 4,) " that the single obstacle of not knowing how to manage lutes, is quite sufficient to repel the efforts of the most zealous in this kind of operation." To compose the fat lute of the chemists, take any quantity of good grey or blue clay, or fuller's earth, and dry it in thin cakes in an oven; then pound it finely and sift it; beat a sufficient

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[1] Mr. Mushet has written several very instructive papers on this subject: see *particularly Phil. Mag. vol.* XXXII.

quantity of this pulverised clay with boiled lintseed oil in an iron or bell metal mortar till the whole mass is of a uniform colour; it will then be fit for use. That which has been made for a twelvemonth, if it have been kept in a covered earthen pot in a cellar, is better and more pliant than when newly made. A large quantity ought always to be made beforehand, when the work is extensive. "I strongly insist," says Des Charmes, page 14, "on the perfection of this lute, because it is the soul of the distillation process."

FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA,

For the Promotion of the Mechanic Arts.

America seldom adopts any thing useful from the old world which she does not improve; and it would have been strange if, in adopting our plan of Institutions for the instruction of mechanics and artizans, she had not made some improvement on, or addition to, our plans. By the kindness of the President to our Mechanics' Institution, we have been favoured with a perusal of the first annual report of the proceeding of the Franklin Institute of Pennsylvania, for the promotion of the Mechanic Arts; and we shall, from it, for the gratification of our readers, give a short account of that Institution. It was originated in February, 1824; and on the 30th of March, an act was passed by the Senate and House of Representatives of the Commonwealth of Pennsylvania, incorporating the members, and granting them the privileges of a public body. The object of the Institution is as expressed in its title, "the promotion of the Mechanic and useful Arts;" and they propose to effect this by the establishment of popular lectures on the sciences connected with them; by the formation of a cabinet of models and minerals, and a library; by offering premiums on all objects deemed worthy of encouragement; and by examining all new inventions submitted to them. The offering of premiums, and the *examining* of new inventions, our readers will perceive to be an addition to what has yet been attempted in any Mechanics' Institution in this country. It certainly will tend much to promote the objects of the Institution; and we should be very glad to see this improvement adopted by some of our own Institutions.

A regular system of lectures has been adopted; four Professorships created; *viz.* Natural Philosophy, Chemistry, and Mineralogy, as connected with the Mechanic Arts and Manufactures, Architecture, and Mechanics; the first of these was vacant at the time of the publication of the annual report; the others had been filled by the appointment of Dr. Paterson, and Messrs. Keating and Strickland, who had lectured last winter in the following order:—Dr. Paterson and Mr. Strickland alternately every Monday on Mechanics and Architecture; and Mr. Keating every Saturday on Chemistry. This regular system commenced on the 10th of November last. The Wednesday was originally reserved for volunteer, and occasional lectures on miscellaneous subjects, and has been hitherto occupied by the following gentlemen; *viz.* Mr. Espy has lectured twice on the nature and objects of the Barometer; Dr. Godman has delivered two lectures on Anatomy, as explaining the principles of motion in the human frame, and on the circulation of the blood; Mr. Browne had lectured three evenings on the law of patent rights; and Dr. Griffiths had commenced a series of lectures on the diseases incident to the labouring classes of the community. This system of instruction it was intended should continue throughout the winter season. Besides this there was a prospect of practical lectures on different arts; and, as a commencement, the committee announce in their report, that a lecture on the art of Pottery was to be delivered by a gentleman practically conversant with it.

Considerable attention had been bestowed on the formation of the mineralogical collection and library; and also to the establishment of a cabinet of models. The architectural models were provided, which were of great importance to Mr. Strickland in the illustration of his lectures. Several of the mechanical models had been executed, and contracts for the preparation of the remainder had been entered into. The sum of 300 dollars had been expended during last year for this object, and this did not include those making at the time of the report.

Preparations were made for holding exhibitions; and the first took place on the 18th of October last, to which all persons interested in the success or promotion of American manufactures were invited to contribute. The exhibition far exceeded the expectations of the committee; was generally visited by the members of the Institute, and by the public at large; and was of great benefit to the Institute by gaining for it an immense accession of members. It is intended that another exhibition shall take place in October next. To excite a higher emulation among the mechanics and manufacturers, a list of premiums, to be awarded at the exhibition, was prepared and circulated, and of these the committee had the pleasure of awarding fourteen. A list of eighty-three premiums has been published, which are to be awarded at the exhibition in October 1825; and there can be little doubt that these, and the additional time for preparation, will render the second exhibition much superior to the first.

There can be little question as to the success of an Institution commenced so prosperously; and the rapid accession of members which it has received, clearly shows the interest taken in its prosperity by the good people of Philadelphia. There were at the commencement of this year, the names of upwards of six hundred individuals entered as members of the Institute.

LETTERS AND QUERIES.

ON DRAINING OLD WASTES IN COAL MINES.

Gentlemen,—I am a reader of your Magazine, though not a mechanic, and from it I have frequently received both instruction and entertainment; of its utility I need say nothing, better judges having long ago given their opinion. In some of the late Numbers, I observe a controversy has arisen on the mode of draining old wastes in coal mines. The discussion has originated, I perceive, in a query by a Coal Hewer; this query is answered by G. M., and G. M.'s answer is replied to by S. S. and by A. K. J. The propositions of G. M. if they had been understood in the manner in which he entertained his ideas on the subject, I believe there might, in some sense, have been little or no cause for calling his views in question. A question may be, whether the parties had similar ideas respecting the purport and meaning of the query. G. M.'s ideas of the nature of that query, may have led him partly astray. He appears to have imagined, that the waste is to be met with, not by running into an old coal pit entirely filled with water, but one that has been filled up with earth, &c., or containing only a small quantity of water. Should these not have been his ideas, I have erred on the side of good feeling. Should he have supposed as I have observed, then the use of his syphon may be so far allowed, but not otherwise; as in the event of the pit being filled, or nearly so, with water, then the necessity of the syphon must be obvious: in that case, where is the use of its application? what, in the name of wonder, is it then to do? must he empty the pit by the mouth? In doing this, he would certainly devise ends to meet the wishes of the querist; he might thus throw the waste water through a good corn or pasture field, in place of conveying it on a subterranean journey through the dark bowels of the earth. But this is in no respect agreeable to the nature of the query. It is plain, that the water is to be conveyed to the engine pumps of the new workings. This, of course, cannot be done but by a subterranean passage. This passage may be longer or shorter, according to pleasure; but always allowing a certain thickness between the new workings and the waste, according to the supposed weight of water that is contained in the waste. Should this passage be only the entrance to a spring or springs of water, rather than a collected body of water, then a passage of any width might suffice, as not more water would issue from it perhaps than the engine could draw; or, if otherwise, the course might be easily made to answer according as circumstances would show. Should there be a large body of water, perhaps to secure safety it might be necessray that a very small outlet therefrom be made, and the nearer this enters the bottom of the pit the better. Should the workings alone be filled with water, then the water will be about the level of the seam of coal working; then, unless a bore be made through the coal seam, or beneath it, the water could not satisfactorily be carried off but by the application of a syphon.

G. M.'s ideas in regard to the use of the syphon, appear to be, that there was only a small quantity of water in the waste, not many feet; the passage was then to be carried to near the surface of the water, and the syphon from thence placed therein; but G. M. can best tell, perhaps, how the syphon could properly and conveniently be got there, and what advantage it would be, put in contrast with running a passage immediately to the bottom of the pit, and striking at the whole of the evil at once, and that in such a manner, as that neither danger nor farther trouble, than merely running it off, could be experienced from the water.

That such is the most efficacious mode of doing away with the evils arising from wastes, is the humble opinion of,

Yours, &c.

L. M.

6th June, 1825.

Gentlemen,—I see in No. LXXV. G. M. wishes to make it appear, that he has the theory, if not the practice, of coal mining.

I must inform him that I made no such conclusion as, "that, to act according to *his plan*, the waste must be exactly ascertained." Where this is mentioned, it is with reference to the plan I proposed. But we will set his syphon to work. He says, his bore or funnel may begin any where, provided it end about the surface of the water contained in the waste. Now, we will suppose that the distance of the old pit in the waste, from the engine pit, is 100 fathoms, which is no great distance; and that the water in the waste is running out at the mouth of the old pit, which will be the case if the fountain head is above the level of it; and also, we will suppose that it is 30 fathoms deep. Now, G. M.'s syphon, in this case, must be placed upon the surface; the one leg entering the old, and the other the new, pit, a distance of 100 fathoms, which will only drain the waste 34 feet. Now, after this, a funnel must be cut 100 fathoms, and his syphon applied again to drain it 34 feet more; and so on, until you reach the bottom of the pit. So I think we will let his syphon *run*.

Other cases more favourable to G. M. might be stated, but without any probability of his plans being adopted.

I had nearly forgot his "Gutter," but what would G. M. think of one 30 fathoms deep and 100 long?

I am, yours, &c.

A. K. J.

Kilwinning Colliery,
6th June, 1825.

QUERIES.

A mechanic, lamenting the loss on capital which must have been sustained by the cotton manufacturers during the late strike, inquires, with much simplicity, if a spinning machine could not be made to work *itself* without a man? We believe many attempts have been made to supersede the necessity of employing men, but hitherto without success.

W. C. wishes to know the best remedy for chopped (Scoticé, hacked) hands.

MISCELLANIES.

Superficial knowledge.—It is asserted that this is the age of superficial knowledge; and amongst the proofs of this assertion we find Encyclopedias and other popular abstracts of knowledge particularly insisted on. But in this notion, and in its alleged proofs there is equal error. Wherever there is much diffusion of knowledge there must be a good deal of superficiality; prodigious extension implies a due proportion of weak intension; a sea-like expansion of knowledge will cover large shallows as well as large depths. But in that quarter in which it is superficially cultivated, the intellect of this age is properly opposed, in any just comparison, to an intellect without any culture at all: leaving the deep soils out of the comparison, the shallow ones of the present day would in any preceding one have been barren wastes. Of this our modern Encyclopedias are the best proof. For whom are they designed, and by whom used? By those who in a former age would have gone to the fountain head? No; but by those who in any age preceding the present would have drunk at no waters at all. Encyclopedias are the growth of the last hundred years; not because those who were formerly students of higher learning have descended, but because those who were below Encyclopedias have ascended. The greatness of the ascent is marked by the style in which the more recent of the Encyclopedias are executed: at first they were mere abstracts of existing books—well or ill executed: at present they contain many original articles of great merit. As in the periodical literature of the age, so in the Encyclopedias it has become a matter of ambition with the publishers to retain the most eminent writers in each several department. And hence it is that our Encyclopedias now display one characteristic of this age, the very opposite of superficiality, (and which on other grounds we are well assured of,) *viz.* its tendency, in science, no less than in other applications of industry, to extreme subdivision. In all the employments which are dependent in any degree upon the political economy of nations, this tendency is too obvious to have been overlooked. Accordingly, it has long been noticed for congratulation in manufactures, and the useful arts, and for regret in the learned professions.

The Camera Obscura.—In a letter from Sir Henry Wotton to Lord Bacon is the following curious relation respecting Kepler, the celebrated astronomer and mathematician; to whom Sir Henry, then being ambassador to one of the princes of Germany, had made a visit.

"I laid a night at Lintz, the metropolis of the higher Austria, but then in very low estate, having been newly taken by the Duke of Bavaria, who, *blandiente fortunâ*, was gone on to the late effects: there I found Kepler, a man famous in the sciences, as your lordship knows, to whom I purpose to convey from hence one of your books, that he may see we have some of our own that can honour our king, as well as he hath done with his carmonica. In this man's study I was much taken with the draught of a landscape on a piece of paper, methought masterly done; whereof inquiring the author, he betrayed by a smile it was himself, adding that he had done it *non tanquam pictor, sed tanquam mathematicus.* This set me on fire; at last he told me how. He had a little back tent, (of what stuff is not much importing,) which he can suddenly set up where he will in a field, and it is convertible, like a wind-mill, to all quarters at pleasure: capable of not much more than one man, as I conceive, and perhaps at no great ease; exactly close and dark, save at one hole, about an inch and a half in the diameter, to which he applies a long perspective trunk, with a convex glass fitted to the said hole; and the concave taken out at the other end, which extendeth to about the middle of this erected tent; through which the visible radiations of all without are intromitted, falling upon a paper which is accommodated to receive them; and so he traceth them with his pen in their natural appearance, turning his little tent round by degrees till he hath designed the whole aspect of the field. This I have described to your lordship, because I think there might be good use made of it for chorography; for otherwise to make landscapes by it were illiberal; though surely no painter can do them so precisely."

Luminousness of the Sea.—The sparkling and luminousness of the sea at night is sometimes a very beautiful phenomenon. The finest display of the kind I ever beheld took place in the 3d degree south latitude. One dark and rather hazy night about eight o'clock, the sea within ten yards of both sides of the vessel suddenly became studded with a vast profusion of dazzling stars, which varied in colour and magnitude, and continued to vanish and disappear and appear again, as if they had been alternately extinguished and rekindled. Some emitted a gloomy white light, and others exhibited shades of blue and faint red. We were going about eight knots, and the reflection from the ship's wake was so strong that the poop and after cabin were completely illuminated. The train which extended from the rudder was indescribably magnificent, being about half a mile in length, and exhibiting a vast assemblage of fiery orbs, co-mingling, uniting, dispersing, flashing, breaking into fragments, and changing colour, without intermission. While all this was going forward, I observed that large portions of the neighbouring sea were at intervals suddenly covered with a glow of blueish light, which increased in intensity for a few moments, and then vanished away. These vivid patches could be distinguished nearly as far as the horizon; but they occurred most frequently in the vicinity of the starry train above described. The whole spectacle continued in its glory about half an hour, after which the luminousness diminished by degrees, and at length disappeared altogether.—*Howison's Foreign Scenes.*

The Properties of Aquavitæ.—The following are among the properties which, according to old Holinshed, whisky possesses, when properly used and moderately taken. —It drieth up the breaking out of hands, and killeth the flesche worms, if you wash your hands therewith. It scowreth all scurfe and scalds from the head, being therewith daily washt before meales. Being moderately taken, it sloweth age; it strengtheneth youth; it helpeth digestion; it cutteth flegme; it abandoneth melancholie; it cherisheth the heart; it lighteneth the mind; it quickeneth the spirits; it cureth the hydropsie; it healeth the stranguarie; it pounceth the stone; it expelleth the gravelle; it puffeth awaie all ventositie. It keepeth and preserveth the head from whirling; the eies from dazeling; the toang from lisping; the mouth from muffling; the teeth from chattering; and the throte from rattling. It keepeth the weasun from stifling; the stomach from wambling; and the heart from swelling; the belie from whitching; the guts from rumbling; the hands from shivering; and the sinews from shrinking; the veins from crumpling; the bones from akeing; and the marrow from soaking.

The Barber's Pole.—Many mistakes have been made on the origin of a barber's pole, which is vulgarly supposed to be indicative of the poll or head of his customers: this is a far-fetched, although a popular conceit; that various-coloured staff being no more than a sign that its master could breathe a vein as well as mow a beard, and professed bleeding as well as shaving: the custom then being, which is yet observed in some villages, for the practitioner to put a staff into the hands of his patient while the latter was undergoing the operation of phlebotomy.

NOTICES TO CORRESPONDENTS.

Our Correspondents must be deferred to next week; none of them, however, are forgotten.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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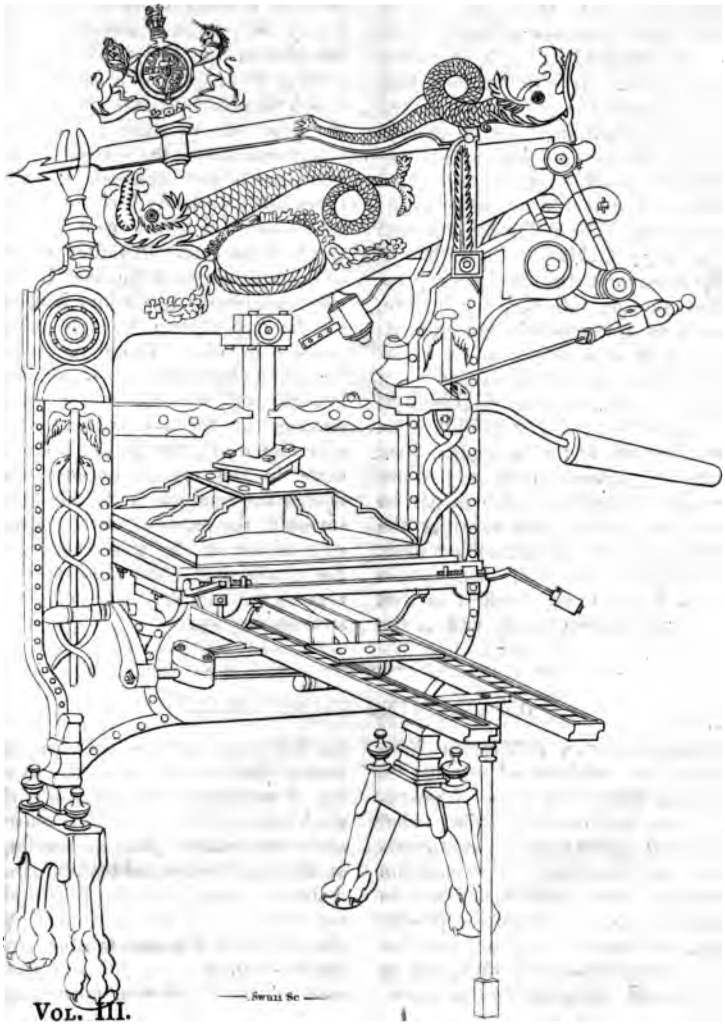
A Committee of Civil Engineers and Practical Mechanics.

> " Philosophy, the great and only heir
> Of all that human knowledge which has been
> Unforfeited by man's rebellious sin,
> Though full of years he do appear,
> Has still been kept in nonage till of late,
> Nor managed, nor enjoyed his vast estate."

No. LXXIX. *Saturday, 25th June,* 1825. Price 3*d.*

COLUMBIAN PRINTING PRESS.



COLUMBIAN PRINTING PRESS.

This printing press, which, so far as we can judge, is superior to any which has yet been brought into use, was invented by Mr. George Clymer, formerly of Philadelphia, now of London. After introducing it into pretty general use throughout the United States, the inventor came to Britain, for the purpose of bringing it into notice in Europe. The plate requires certainly little or no explanation, as it is sufficiently plain. It will be seen that in this press the power is obtained by a combination of levers, instead of by the screw; and the power thus obtained is, it seems, much greater than that of any other printing press. The difference between the large Columbian and that of the most improved and largest press now in use, has not, we believe, been as yet precisely ascertained; but it is said that a much better impression can be produced by it from double demy or double royal forms, with a pull much lighter than is agreeable to the pressman, than can be produced from any other press by applying both hands to the bar handle, and exerting the utmost stretch of manual strength. This power, however, is susceptible of gradation to the smallest as well as to the largest forms, and in the hands of a good workman, it is equally well adapted to all kinds of work—to a single octavo page, or the smallest card, or the heaviest double royal sheets. Indeed, such is its power, that it has been found sufficiently easy for a boy of fifteen to pull down. Besides want of power in the ordinary printing presses, another most obvious defect is an imperfect adjustment of the platten and bed for the types, causing an inequality of impression which frequently baffles the skill of the pressman to remedy. In the Columbian press, the surface of the iron platten and iron bed for the types being perfectly level, an equal impression on every part of the sheet is insured. Another of its advantages seems to be, that by its use considerably less injury is done to the types than by the other presses in use. From its great power, a sharp impression can be brought off without indenting or sinking the types into the paper, whereby much less injury will be done to the types; because the deeper the impression is, the more severely the paper operates on the extremities of the sharp angles of the types, and, consequently, they receive the quicker and more destructive injury.

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ON GRAFTING FRUIT TREES.

Experimental cultivators have varied the methods of grafting in various ways; but those of practical use are *whip grafting*, *cleft grafting*, *crown grafting*, *root grafting*, and *inauhing*. For common grafting trees, which are set in gardens that are kept for private use, the standard or stock may be from three to four feet high, and to begin and complete the operation, the following implements are necessary: 1st. A neat small hand saw. 2d. A grafting or strong knife with thick back. 3d. A grafting chisel and small mallet. 4th. A budding or sharp pen knife. The following materials must also be provided. 1st. Strings of hemp or woollen yarn, to tie the graft and stock together. 2d. A composition of good binding clay, horse and cow dung, straw cut small, and a little salt; the salt is to prevent the composition from cracking in dry weather. To proceed to the different methods of grafting, I shall only at present mention the first, *viz.*

Whip Grafting.

This is the most expeditious way, and in most general use. The stock upon which it is to be performed must be slender and correspond with the thickness of the graft. Having headed the stock at some clear smooth part, slope it on one side with a knife, in a very acute angle; make a slit on the lower side of the slope, to receive the wedge or tongue of the graft. Secondly, have the grafts prepared, cut into lengths; take one which fits the stock in size, and slope the bottom of it so as to fit the stock, that the graft and stock may correspond exactly; cut also at the bottom of the graft a slit (like that in the slope of the stock) to receive the sharp end of the stock. Then unite the graft to the stock as evenly and completely as possible. Let the graft be carefully held in its due position, while a bandage is applied. Carry the string of woollen yarn in a neat manner round the stock and graft several times. Lastly, cover the joint with the composition of clay; (which should be well wrought and kept damp;) coat from half an inch below the bottom of the graft, to an inch above the stock, and to the thickness of half an inch all round; finish it in an oblong globular form, taking care to work it so close that no *wind*, or *wet*, or *sunshine* may penetrate.

C. D.

Woodside, 16th June, 1825.

OBSERVATIONS ON MOSAIC.

MOSAIC is a kind of painting by means of small bits of glass, stone, wood, enamel, and other substances of different colours, cemented to some surface by some sort of mastic, and which may be executed in such perfection, that at a little distance a common eye would take it for real painting. The common name *mosaic*, comes from the Italian *musaico*, derived from the Greek word *musakion*, used in the lower ages to denote those kinds of works called in Latin *musivum*.

Though this kind of painting was very common among the ancients, Pliny speaks neither of works in mosaic, nor of artists who exercised it. We cannot judge, therefore, of the mechanism of the art but from the manner in which it is executed by the moderns, and from the ancient monuments of this kind which have been preserved. To construct works in mosaic, the artist first forms a ground of flat stones, bordered with bands of iron, and surrounded with a solid rim of stone. This ground is covered with thick mastic, in which the coloured pieces of glass, stone, &c. are implanted according to the design traced out on the ground; and during his labour the artist has before him the painting he intends to copy. This mastic acquires the hardness of stone, and when the whole has sufficient consistence, it is polished in the same manner as glass. As the splendour, however, which mosaic then acquires, prevents the design from being accurately distinguished, large works intended to be viewed at a distance, such as those placed in ceilings, cupolas, &c. are not polished. The art has been discovered of giving to the colour of the glass as many different shades as are necessary for executing paintings of every kind. The artist in mosaic, while at work, has the pieces of glass, marble, &c. ranged in cases, according to their different shades, like a printer's types. The art of making mosaics in relief is said to have been invented several years ago by Pompeo Savini, of Urbino. Archenholz, in his Picture of Italy, asserts, however, that no work of importance was ever executed according to this method. Some have also tried to saw through mosaic works in a transversal direction, in order to multiply them. According to Bjornstahl, in the second volume of his Travels, Pompeo Savini was the first person who tried this method at Rome. It appears that pavements in coarse mosaic, executed among the ancients, were not made at the same period as those of more delicate workmanship. The place where it was necessary to implant the mosaics were in the former left more delicately terminated. Thus, at Herculaneum, according to Winkleman, there was found, in the middle of a coarse mosaic pavement, a portion of mosaic of more delicate workmanship, which did not adhere to the rest, and which only had a relation to it.

It appears that the origin of mosaic ought to be ascribed to the different compositions of hard stones employed by the orientals as ornament, and of which we find a striking example in the ornaments of the high-priest among the Jews. It is observed in general, that all nations among whom civilization has made little progress, are fond of splendid and variegated colours: we find, therefore, that mosaic was in great esteem during the first centuries of the French monarchy, as is proved by the mosaics with which Clovis caused the church of St. Peter and St. Paul, at present that of Sainte Genevieve, and the tomb of Fredegonda, to be ornamented; and hence it became usual to cover surfaces with coloured bodies, according as their figures permitted them to be joined, and to ornament buildings, pavements, ceilings, &c. with stones of different colours. It is probable that the Persians, Babylonians, and other people of the East, whose countries abounded with hard stones, were acquainted with this kind of embellishment. They displayed a considerable degree of ingenuity in executing flowers, animals, &c. by the combination of pieces of stone of different colours: this was the extent of their art; but it was the Greeks who introduced into this process that taste and perfection which entitle it to the appellation of an art. These people, indeed, found means to manage the shades with so much dexterity, and to give to the figures and groups which they executed, such order and harmony, that at a distance they resembled paintings.

This art was conveyed from the Greeks to the Romans. Sylla was the first among the latter who caused to be executed, in the temple of Fortune at Præneste, at present called Palæstrina, a mosaic, great part of which still exists. At first the pavements of buildings only were ornamented in this manner, but afterwards walls and arched ceilings. Portable floors for the tents of princes and the commanders of armies, in order to guard against moisture, were ornamented also in the same manner. The invention of coloured glass gave to this art a greater degree of perfection. This material in particular was employed in the time of Augustus. But pieces of glass or marble were still of too large size to admit of the shades being properly blended, and, consequently, of giving the natural colour to the objects. Under Claudius, the Romans began to colour marble, and under Nero, to give it spots by an artificial process.

In the fifth century, when the arts were expelled from Italy, by the invasions of the barbarians, mosaic painting and sculpture were preserved much longer among the Greeks of Byzantium for ornamenting the altars and utensils of the church. Mosaic, however, lost at Constantinople, as the other arts did, that character of elevation which characterises the monuments of Grecian art; besides, works of this kind were executed with pearls and precious stones, whereas the ancient Greeks preferred marble for mosaic. Towards the end of the thirteenth century, an Italian named Andrew Tassi, learned the art of mosaic from one Apollonious, a Greek, who decorated with it the church of St. Mark at Venice, where an excellent pavement by him is still to be seen. But in general these works want design, are in a bad taste, and, besides, have a bad colour. Since that period, this art has been carried to a high degree of perfection in Italy. Pope Clement VIII. contributed greatly to this improvement in the seventeenth century, by causing all the interior part of the cupola of the church of St. Peter to be ornamented with mosaic. Among the artists employed for this purpose, the most distinguished were Paul Rosetti and Francis Zucchi. These ornaments were finished in 1603. In the same century John Baptist Calandra, of Vercelli, in Piedmont, who was born in 1586, and died in 1644, invented a new mastic, which greatly contributed to bringing the art to perfection. During fourteen years he executed mosaics for the church of St. Peter at Rome, and particularly the figures of the four fathers of the church in the cupola, after paintings by Lanfranchi, Sacchi, Romanelli, and Pellegrini. He copied also the picture of the archangel Michael, by Joseph Cesari; but he gave it too fine a polish, so that it has too much reflection. Afterwards various artists in mosaic endeavoured to give faithful copies of the finest paintings, such as that of the martyrdom of St. Petronilla, by Guerchin, in the church of St. Peter at Rome; the death-bed communion of St. Jerome, by Domeniquin, formerly in the church of Santo Girolamo della Carita at Rome, but now in the Museum of the Arts at Paris. The person, however, who carried this art to its highest degree of perfection, was Peter Paul de Christophoris, who founded at Rome a school of mosaic in the commencement of the eighteenth century. He formed several distinguished pupils, among whom were Brughio, Conti, Coccei, Fattori, Gossone, and Ottaviano. Alexis Matthioli found out, in 1730, the art of making glass of a bright red colour. In modern times, mosaic has been distinguished into two kinds: that of Rome, in which stones of a very small size are employed, which gives to works more delicacy and variety, and admits the execution of great historical paintings. In this manner the most beautiful paintings of Raphael have been copied, and Clement VIII. caused the cupola of the church of St. Peter to be decorated with mosaic of the same kind. His successors continued to cause other paintings, both in oil and in fresco, to be copied. According to Bjornstahl, the number of shades found in these mosaics sometimes exceeds 10,000. In the palace Borghese, at Rome, there are six beautiful mosaics, one of which represents Orpheus surrounded by animals: it is said to be composed of 9000 pieces. The mosaic of Florence, called by the Italians *commesso*, is executed with larger stones, and is employed for copying paintings of less size. The best works of this kind are in the chapel of the grand duke, at Florence. Several beautiful mosaics of this kind are now in the Museum of Arts at Paris.

One of the greatest advantages of mosaic is its resistance to every thing that generally alters the beauty of fine paintings, and the facility with which it may be cleaned, by giving it a new polish without any danger of destroying the colours. As mosaic, however, can be executed only in a slow manner, and as it requires considerable expense, it never can be brought into such general use as painting; it would never even have attained at Rome and Florence to that degree of perfection to which it was carried, had not the governments of these two countries defrayed the expenses.

In modern times very beautiful mosaics in wood, known in England by the name of *inlaying*, in France by that of *marqueterie*, and in Italy under that of *tausia* or *tarsia*, have been executed in different countries. Phillip Bruneleschi and John de Vanone, at Florence, who lived in the fifteenth century; John Marc, of Blois, who worked for the king of France; and Melchior Rummer, who resided near Heidelberg, distinguished themselves most in the execution of this sort of mosaic. Shell-work may be considered also as a kind of mosaic. In one of the groves of Versailles there is a master-piece of this kind. Bonavita Blank, director of the cabinet of natural history at Wurzbourg, is the inventor of a new kind of mosaic, in which nothing is employed but different sorts of moss, and has been able to execute, with the greatest fidelity, landscapes, marine views, volcanoes, ruins, and buildings. The beautiful collection of this artist has been exhibited in four halls of the castle of Wurzbourg since 1794, the period when it was purchased by the bishop.

The Italians at present often employ antique mosaics to ornament the floors of their apartments; and they make use of a very ingenious process, before they remove the mosaic, for fixing with cement the small cubes which compose it; also for detaching it from the place which it occupies, and for depositing it in a new one. They cut it into portions, fix them on large sheets of paper called *perpetuo*, surrounded with iron, which they number, and afterwards, when they wish to make use of them, they place the pieces on the floor according to the numbers; and these portions, when joined, form a whole as smooth as it was before the mosaic was displaced.

ESSAYS ON BLEACHING,

By James Rennie, A. M. Lecturer on Philosophy, &c. &c., London.

No. III.—CHEMICAL AGENTS USED IN BLEACHING.

SECTION I.

As bleaching is wholly carried on by the chemical action of certain agents upon the goods to be bleached, it is obvious that the consideration of such agents ought to hold a distinguished place in an essay on the art. If bleachers, indeed, were better acquainted than they usually are with the chemical agents which they employ, their processes would be carried on with more certainty, with more rapidity, and, for the most part, with more economy. Certainly no improvement of much importance could be made by any body, unless he had previously possessed a knowledge of the chemical properties of the agents and the materials to be operated upon. I hope the utility of the subject will form a sufficient apology if I should dwell on these agents at some length. I shall begin with one which is often omitted by those who have written on bleaching; namely, water.

1. *Of Water as an Agent in Bleaching.*

In all the processes which have ever been invented for bleaching, water is a principal and necessary agent; and it is not likely that any mode will ever be discovered in which its use may be dispensed with. Nay, the most ancient process seems to have consisted in little more than frequent waterings and evaporation; and even at this day, in some parts of India, as we are told by Des Charmes, (p. 263,) this mode has never been laid aside nor improved. This ingenious chemist has made some interesting experiments on water bleaching, which it may not be improper in this place to detail. He was led to consider the subject from two observations which he had frequently made. The first was, that rags of unbleached cloth, when set to ferment for the purpose of making blotting paper, became white to a certain point from washing and soaking. The second was, that pieces of brown linen which are sewed upon accidental holes or rents in cloth, to prevent such from enlarging in the fulling mill, became, in two or three days, as white as if they had been several months subjected to the usual mode of bleaching. To ascertain the extent to which he might generalize these observations, he began his experiments by macerating (p. 261) a quantity of flax in pure river water, in which it was allowed to remain till air bubbles arose to the surface, when it was found to have changed from grey to light yellow. The water was then changed, and the same process repeated, when it was washed in warm water. This treatment disengaged a great quantity of colouring matter, and the flax became in a state of division, white and beautiful; but in the mass it had a slight tinge of yellow. This farther experiments might probably have removed. The same chemist macerated in water, for a fortnight, dry hemp stalks gathered six months before. They were then rubbed under water till the fibrous part appeared. This was separated and left to seep for several days in fresh water, when it was again rubbed and again immersed. It now appeared a very beautiful white, nearly equal to that bleached in the usual way. These experiments prove that water bleaching is practicable, and lead us to infer that Mr. Lee's process, if generally adopted, is likely to supersede every other mode.

The qualities of water it is necessary to attend to at the most early stage of the preparation of flax, namely, when it is in the watering trough; for if this is not taken notice of, the flax may be rendered good for nothing. I therefore reckon next in importance to Dr. Home's introduction of sulphuric acid souring, his experiments upon water — experiments which every manufacturer should be well acquainted with, and of which no chemist should be ignorant. He found that flax steeped for the usual time in hard water, was little more affected than when put in, and even when it was longer immersed, that it did not acquire that smoothness to the touch arising from the dissolved mucilage of the flax, which is the criterion of flax properly steeped. This seems to arise from the power possessed by hard water of retarding putrefaction, a quality which was known so long ago as the time of Celsus; *Aqua dura,* i. e. *ea quæ tarde putrescit.* For the steeping of flax is designed to introduce the putrefactive fermentation, in order to loosen the fibrous from the woody part; and the neutral salts in hard water, in consequence of their affinities, not only retard the process, but actually prove injurious to the fibres. The strong antiseptic qualities of moss water render *it* equally hurtful. After this plain experimental statement, it is somewhat strange that Mr. Higgens (p. 9) asserts directly the contrary; namely, that flax steeped in water rendered hard by selenite, soon becomes rotten. The sulphate of lime he admits to be the strongest antiseptic of any saline body; but although putrefaction may be retarded by a large quantity of an antiseptic, it is quickened by a small quantity, as is proved by the curing of meat with common salt. Hard waters, then, seem, according to this view of the matter, to act too powerfully on the flax, by extending the putrefaction to the fibres themselves. When soft water again is used, the fermentation goes on readily; and if it do not, it should be assisted, on the same principle that bread is leavened, by the addition of some substance, in an actual state of putrid fermentation. The Dutch, to whom we were formerly so much indebted for bleaching linen goods, are well aware of this, and carefully lay over the flax, when put in the pond, a quantity of mire and dirt, previously taken from the bottom. Water, then, which is hard, and much more moss water, ought to be carefully avoided in this process. The latter requires several weeks or even months to induce the proper degree of fermentation. It is the more requisite to mention this, that some may suppose moss water, from its great softness, to be the best which can be used.

Dr. Home mentions three different sorts of water. The first, neither changes with alkaline salts nor curdles soap; the second, loses its transparency on the addition of such salts, but it does not curdle soap; the third, both curdles soap and becomes lactescent with the salts. The first sort is what is called soft water, and ought always to be used; the two latter sorts, and particularly the last, ought never to be employed in bleaching. The most common extraneous additions in our waters, which are the causes of their hardness, are the sulphate of lime and the sulphate of magnesia, together with the supercarbonate of lime. When soap is used with such waters, a double decomposition takes place; the sulphuric acid of the selenite unites with the alkali of the soap, and forms sulphate of potass, or sulphate of soda, which remains in solution; while the magnesia or the lime unites with the tallow, and forms an earthy soap, an insoluble compound which swims upon the surface of the water like curds. In this way, hard waters require much more soap for any given purpose than rain water, or waters which do not contain earthy salts. In washing linen, for example, it would require as much soap to produce a proper effect, as would supply a sufficient quantity of alkali and tallow for combining with the sulphuric acid, and the lime or the magnesia nearly to the point of saturation. The loss which would thus be sustained in extensive works is obviously great, and demands the serious attention of the manufacturer. In the process also of boiling linen in alkaline leys, hard water produces great injury and waste of alkali; for the sulphuric or carbonic acid of the water combines with the alkalies, neutralizes them, and, consequently, renders the ley quite effete for the purposes of bleaching.

The saline substances, then, which render water hard, must be either decomposed or neutralized at the expense of the alkali, before the effect intended can be produced; and the bleacher may, in this manner, without being aware of it, lose whole tons of potash and soda, not to mention the extra consumption of the expensive article of soap.

In choosing a situation for a bleachfield, then, the very first circumstance to be attended to is the quality of the waters. In some cases this may be known at once from the mineral products of the vicinity. In a lime district, for example, it may be inferred with considerable certainty, that the waters will hold, in solution, either the sulphate or carbonate of lime. If water, again, runs through gravel, it is likely to be nearly pure and soft; for the gravel acts as a natural filter, and separates all extraneous matter which does not exist in it in a state of chemical combination. It may be remarked, however, that water which holds the earths mechanically suspended, that is, such as appears muddy, is somewhat less prejudicial than that which holds them in solution. In the first case, they attach themselves but loosely to the stuff; in the second, they are precipitated in a state of minute division, and combining with the acids or the alkalies used in the several processes, they become intimately united with the cloth. The inexperienced should here be cautioned not to trust too much even to waters which appear soft, without subjecting them to chemical analysis; for they may contain substances injurious in bleaching, though they do not curdle soap. This may particularly happen with regard to rivers running over calcareous strata, or through a district where lime is much used for the purposes of agriculture, in which case, the lime will be mechanically mixed with the water. Now, whenever cloth which has been washed in such water, is put into the souring vat, the lime which it will take up from the water, and which must adhere to it, will instantly combine with the sulphuric acid and form an insoluble compound, which no subsequent process yet known can entirely remove. Where no other waters can be had, fine calico bleaching for the purposes of printing can never be attained. An instance is given by Mr. Parkes, (Chem. Ess. IV. 163,) which sets this in a very strong point of view. In an extensive work for bleaching and printing calicoes in Scotland, the water of the river Don was used, but the process being always attended with uncertainty, the proprietors tried all the springs adjacent to the manufactory by chemical analysis. A spring was thus discovered which required a less expenditure of alkali in the process, and improved the look of the finished goods. This water, although distant three miles, they conveyed through pipes to the work, where it fell into a cistern containing a thousand gallons, made with granite and Roman cement, and well puddled on the outside with clay. The cost of this water work was above £2000, and yet the proprietors say that they have no cause to regret the expense. It is of importance in cases of this kind to ascertain how much water a pipe of a given calibre will deliver in a certain time; because iron pipes, when not kept nearly full, oxidize on the inside and spoil the water, and, on the other hand, when not large enough, they are liable to burst. At the work on the Don, the oxidizing of the iron is prevented by stopping the circulation of the air in the pipes by means of a stopcock. The reservoir is 50 feet long, 30 feet wide, and only 10 feet deep. It was made so shallow for the purpose of exposing a large surface of water to the air, because the water passes previously over a bed of limestone, and contains, in consequence, some lime in solution, which exposure to the sun and air precipitates by facilitating a combination of the carbonic acid of the atmosphere with the lime. To prevent this precipitate from being disturbed by the rushing in of water from the pipe, a square wooden pipe, placed perpendicular to the reservoir, receives it and carries it to the bottom, where it is quietly distributed. The uppermost stratum of water, then, must always be the purest, and this only, by means of an ingenious contrivance, is what is used. The pipe which conveys the water from the reservoir extends for a considerable length into it, and is fitted with a flexible leather joint, 13 inches long, and also with a rose head, which always is kept near the surface by a large air ball of thin copper, capable of swimming one half above water. The leather tube is prevented from collapsing by means of copper rings. In making a reservoir for a bleaching work, it is of importance to remark that it should be lined with freestone, and not with brick, because most of the bricks of this country have the property of hardening water, which this stone has not.

The same author gives us a similar instance, strongly illustrative of the importance of attending to waters for bleaching, but in which the contaminating substance was different. In the case in question, the bleaching waters ran through a coal field in Yorkshire, and the water from the pits decomposing the pyrites contained in the coal, disengaged the iron and the sulphur, and washed them into the stream. The water of the river (the Calder) was found to answer tolerably well, after heavy rains, on account of the diluted state of the coal waters; but in summer, when the weather is best for crofting, the goods were always stained and yellow. The bursting of a worn out coal pit in the vicinity, by pouring into the river a stream loaded with the results of decomposed pyrites, rendered the water totally unfit for bleaching. The proprietors, as in the former case, procured good water from a distance at a considerable expense. In consequence of which management, their consumption of soap has been so much diminished, from the superior quality of the water, as to save them annually the sum of £50; a very great saving in an establishment which is by no means extensive. The manufacturer should be earnestly entreated to examine carefully such waters as are supposed to be contaminated with iron, because if it exist in them in any considerable proportion, it renders them very unfit for his use; and considering the universal diffusion of iron through the mineral kingdom, water can seldom be found wholly pure from this mineral. In a trap country in particular, iron generally abounds, and we find accordingly, that the bleachers in the neighbourhood of Glasgow find the iron which comes from the basalt rocks very troublesome to manage. Moss waters also commonly contain a large proportion of iron solutions, especially after heavy rains.

CONSTANTINOPLE.

The Bosphorus of Thrace, in whatever point of view it is considered, is unequalled in the interest it excites; whether with reference to the surprising nature of its origin; the number of local circumstances attached to its ancient history; the matchless beauty of its scenery; its extraordinary animal productions; the number of rare plants blooming amidst its towering precipices; its fleets and gondolas, towns, villages, groves, and gardens; the cemeteries of the dead, and the busy walks of the living; its painted villas, verandas, flowery terraces, domes, towers, quays, and mouldering edifices: all these in their turn excite and gratify curiosity; while the dress and manners of the inhabitants, contrasting the splendid costume and indolence of the East, with the plainer garb and activity of the West, offer to the stranger an endless source of reflection and amusement.

It was near midnight when we returned from this excursion. On the following morning we determined to leave the *Moderato*, and proceed to Constantinople in one of the gondolas that ply in the canal for hire. These are more beautiful than the gondolas of Venice; and are often richly ornamented, although destitute of any covering. They are swifter than any of our boats upon the Thames; and this fact, I am told, has been ascertained by an actual contest, between a party of Turkish gondoliers in their own boat, and a set of Thames watermen in one of their wherries. We passed the gorge of the canal, remarkable as the site of the bridge constructed by Darius for the passage of his numerous army; the grandeur of the scenery increasing as we approached the capital. The sides of the canal appeared covered with magnificent pavilions, whose porticoes, reaching to the water's edge, were supported by pillars of marble; when, all at once, the prospect of Constantinople, with the towns of Scutari and Pera, opened upon us, and filled our minds with such astonishment and admiration, that the impression can never be effaced. Would only that the effect produced upon the mind could receive expression from the pen! As nothing in the whole world can equal such a scene, it is impossible by any comparison to convey an idea of what we saw. Le Bruyn, one of the oldest European travellers before the close of the seventeenth century, apologized for introducing a description of this astonishing sight, after the number of relations which other authors had afforded: what must then be the nature of an apology used by an author, who, at the beginning of the nineteenth, should presume to add one to the number; especially when it is added, that more has been written on the subject since the days of Le Bruyn than in all the ages which had preceded him, from the earliest establishment of the Byzantine colonies to the time in which he lived. In the long catalogue thus afforded, no one has been more happy in his description of Constantinople than an author, who had himself no ocular demonstration of the veracity of his remarks.* The Turkish squadron, returned from a summer cruise, were, when we arrived, at anchor off the point of the seraglio. One of the ships, a three-decker, the construction of a French engineer of the name of Le Brun, surprised us by its extraordinary beauty, and the splendour of its appearance. Its guns were all of polished brass; and its immense ensign, reaching to the surface of the water, was entirely of silk.

After what has been said of the external magnificence of this wonderful city, the reader is, perhaps, ill prepared for a view of the interior; the horror, the wretchedness, and filth of which are not to be conceived. Its streets are narrow, dark, and ill paved, and at the same time full of holes and ordure. In the most abominable alleys of London or Paris there is nothing so disgusting. They more resemble the interior of common sewers than public streets. The putrefying carcasses of dead dogs, with immense heaps of dung and mud, obstruct a passage through them. From the inequalities and holes in the narrow causeway, it is almost impossible to proceed without danger of putting an ankle out of joint. We landed at Galata, in the midst of dunghills; on which a number of large, lean, mangy dogs, some with whelps, wallowing in mire, and all covered with filth and slime, were sprawling or feeding. The appearance of a *Frank* † instantly raises an alarm among the animals, who never bark at the Turks; and, as they were roused by our coming on shore, the noise became so great that we could not hear each other speak. To this clamour were added the brawlings of a dozen porters, vociferously proffering their services, and beginning to squabble with each other as fast as any of them obtained a burden. At length we were able to move on; but in such confined, stinking, and yet crowded lanes, that we almost despaired of being able to proceed. The swarm of dogs, howling and barking, continually accompanied us, and some of the largest attempted to bite. When we reached the little inn of Pera, where a few small rooms, like the divisions in a rabbit-hutch, had been prepared for our reception, we saw at least fifty of these mongrels collected round the door in the yard, like wolves disappointed of their prey. The late storms had unroofed several of the houses in Pera; that in which we lodged was among the number: one corner of it had been carried away with the wind, so that, without climbing to the top for a view of the city, we commanded a fine prospect of the *Golden Horn*, and part of Constantinople, through the walls of our bedrooms, which were open to the air. Pera had recently suffered in consequence of a conflagration which had nearly consumed every house in the place. There was reason to believe some improvement would take place during its restoration; but we found it rising from its ashes like a new phœnix, without the slightest deviation from the form and appearance of its parent. The exception only of one or two houses formerly of wood and rebuilt with stone might be noticed; but all the rest were as ugly, inconvenient, and liable to danger as before; and were it not for a few workmen employed in fronting the houses of the merchants, no stranger could discover that any accident had taken place.

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* History of the Decline and Fall of the Roman Empire, c. xvii.

Considering the surprising extent of the city and suburbs of Constantinople, the notions entertained of its commerce, and the figure it has long made in history; all the conveniences, if not the luxuries, of life might be there expected. Previous to an arrival, if any inquiry is made of merchants, and other persons who have visited the place, as to the commodities of its markets, the answer is almost always characterised by exaggeration. They will affirm that every thing a stranger can require may be purchased in Constantinople as in London, Paris, or Vienna; whereas, if truth be told, hardly any one article good in its kind can be procured. Let a foreigner visit the bazars,* properly so called, he will see nothing but slippers, clumsy boots of bad leather, coarse muslins, pipes, tobacco, coffee, cook shops, drugs, flower-roots, second-hand pistols, poiniards, and the worst manufactured wares in the world. In Pera, where Greeks and Italians are supposed to supply all the necessities of the Franks, a few pitiful stalls are seen, in which every thing is dear and bad. Suppose a stranger to arrive from a long journey, in want of clothes for his body; furniture for his lodging; books or maps for his instruction and amusement; paper, pens, ink, cutlery, shoes, hats; in short, those articles which are found in almost every city in the world; he will find few or none of them in Constantinople, except of a quality so inferior as to render them incapable of answering any purpose for which they were intended. The few commodities exposed for sale are either exports from England, unfit for any other market, or which is worse, German and Dutch imitations of English manufacture. The woollen cloths are hardly suited to cover the floor of their own counting-houses; every article of cutlery and hardware is detestable; the leather used for shoes and boots so bad that it can scarcely be wrought; hats, hosiery, linen, buttons, buckles, are all of the same character; of the worst quality, and yet of the highest price. But there are other articles of merchandize, to which we have been accustomed to annex the very name of Turkey, as if they were the peculiar produce of that country; and these at least a foreigner expects to find; but none of them can be had. Ask for a Turkish carpet, you are told you must send for it to Smyrna; for Greek wines, to Archipelago; for a Turkish sabre, to Damascus; for the sort of stone expressly denominated *turquoise*, they know not what you mean; for red leather—they import it themselves from Russia or from Africa; still you are said to be in the centre of the commerce of the world: and this may be true enough with reference to the freight of vessels passing the straits which is never landed. View the exterior of Constantinople, and it seems the most opulent and flourishing city in Europe; examine its interior, and its miseries and deficiencies are so striking, that it must be considered the meanest and poorest metropolis of the world. The ships which crowd its ports have no connexion with its welfare: they are for the most part French, Venetian, Ragusan, Sclavonian, and Grecian vessels, to or from the Mediterranean, exchanging the produce of their own countries for the rich harvests of Poland; and the salt, honey, and butter of the Ukraine; the hides, tallow, hemp, furs, and metals of Russia and Siberia; the whole of which exchange is transacted in other ports, without any interference on the part of Turkey. Never was there a people in possession of such advantages, who either knew or cared so little for their enjoyment. Under a wise government, the inhabitants of Constantinople might obtain the riches of all the empires of the earth. Situated as they are, it cannot be long before other nations, depriving them of such important sources of wealth, will convert to better purpose the advantages they have so long neglected.

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† The name applied to every Christian in the *Levant*, of whatsoever nation.

* Bazar is the Turkish word for Market.

Dr. Clarke.

MISCELLANIES.

Printing.—There is some probability that this art originated in China, where it was practised long before it was known in Europe. That the Romans did not practise the art of printing cannot but excite our astonishment, since they really possessed the art, and may be said to have enjoyed it, unconscious of their rich possession, as they stamped their pottery with stereotype, or immoveable printing types. How, in daily practising the art, (though confined to this object,) it did not occur to such an ingenious people to print their literary works, is not easily accounted for. When first the art of printing was discovered, one side of the paper only was impressed; the means of printing on the opposite side was not then found out. Specimens of these early printed books may be seen in the libraries of his Majesty and Lord Spencer. It was afterwards attempted to paste the two blank sides together, and thus render them one leaf. The blocks were then made of soft wood, and their letters were carved; but frequently breaking, the expense and trouble of carving and gluing new letters suggested our moveable types, which has produced such, almost miraculous, celerity in this art. Our modern stereotype consists of letters carved in brass, which not being liable to break like these blocks of soft wood which they first used, is profitably employed for works which require to be frequently reprinted. Printing in carved blocks of wood must have greatly retarded the progress of universal knowledge; for one set of types could only have produced one work, whereas it now serves for hundreds. Printing was gradually practised throughout Europe from the year 1440 to 1500. Caxton and his successor, Wynkyn de Worde, were our own earliest printers. Caxton was a wealthy merchant, who, in 1464, being sent by Edward IV. to negotiate a commercial treaty with the Duke of Burgundy, returned to the country with this invaluable art. Notwithstanding his mercantile habits, he possessed a literary taste, and his first work was a translation from a French historical miscellany. The tradition of the Devil and Dr. Faustus was derived from the odd circumstance in which the Bibles of their first printer, Faust, appeared to the world. When he had discovered this new art, and had printed off a considerable number of copies of the Bible, to imitate those which were commonly sold in manuscript, he undertook the sale of them at Paris. It was his interest to conceal this discovery, and to pass off his printed copies as manuscripts. But as he was enabled to sell his Bibles at sixty crowns, while the scribes demanded five hundred, this created universal astonishment; and still more when he produced copies as fast as they were wanted, and even lowered his price: this made a great sensation at Paris. The uniformity of copies increased the wonder. Informations were given to the magistrates against him as a magician; his lodgings were searched; and a great number of copies being found were seized. The red ink which embellished his copies was said to be his blood; and it was therefore adjudged that he was in league with the Devil, and Faust was at-length obliged (to save himself from a bonfire) to discover his art to the parliament of Paris.

M. Chambon, a physician of Paris, has proposed a simple and easy plan for removing bees from one hive to another, without danger of being stung. It consists in having the hive made with a top that will open. placing it on a glass, furnished with a metallic plate, under which the smoke may be safely introduced. If an empty hive be placed over the upper aperture, the smoke will force the bees to ascend into it.

Bahama Seas.—One of the most remarkable things in the Bahama seas is the clearness and shallowness of the water. In some places the depth at ebb tide does not exceed seven feet; but even though it approaches to forty, the bottom and all the objects scattered upon it can be distinctly seen. I used often to watch the fishes sporting among the sea weed and rocks around me, or trace the ramifications of the coral that grew abundantly everywhere. I could discover the beautiful convoluted shell-fish of the tropics reposing in their native deeps, and view the barracutta darting like a blue meteor through the clear expanse of ocean around it. Sometimes a shark would follow our vessel for several hours together; at one time swimming rapidly around her in quest of prey, and at another lurking under the keel till something was thrown overboard. He would then rush from his place of concealment and seize the object, whatever it might be. *Howison's Foreign Scenes.*

Machine for making Stove Pipe.—A useful and ingenious instrument has been invented by Mr. John F. Sarchet of Philadelphia, for the purpose of cutting and piercing iron plates for stove pipe, three of which are prepared by it at a single operation by the force of one man, in less than a minute. The cutting is prepared by a kind of circular shears of cast steel, which have been used for a year without requiring to be sharpened. The pincers, which operates at the same time with the shears, are arranged upon cylinders in such a manner that the lines of holes are not parallel, but give to the pipe, when rivetted, a slight taper, so that one section shall fit into another. The sheet of iron is introduced into the instrument sideways; and the work is performed with great apparent ease by turning a crank. This instrument was exhibited at the October exhibition of the Franklin Institute of Philadelphia, and was awarded a silver medal.

New American Rifle.—By this ingenious piece (which was made at Wikesbare in Pennsylvania, and was likewise shown at the exhibition of the Franklin Institute) two loads are fired in succession from the same barrel, and by means of the same lock, so that it presents the advantage of a double-barrelled gun. It is loaded in the ordinary way, except that two loads are introduced at once; corresponding to these loads are their touchholes. The lock is so constructed as to contain two primings upon a double rolling pan; the first communicates only with the forward load, and the second with that remaining. The lock has nearly the same arrangements as that of the double-barrelled pistol with single locks.

Effects of the fumes of Tobacco.—When the evening was pretty far advanced he conducted me to the cabin, which was almost full of packages, and pointing out where I was to sleep left me alone. I felt a heavy suffocating smell, but did not think of examining the contents of the bales, and immediately crept to bed. Soon afterwards I was harrassed by wild and frightful dreams, and suddenly awakened about midnight bathed in a cold dew, and totally unable to speak or move. However I perfectly knew where I was, and recollected every thing that had occurred the preceding day; only I could not make any bodily effort whatever, and tried in vain to get up, or even to change my position. The watch on deck struck four bells, and I counted them, though it seemed to me that I did not hear the beat, but received the vibrations through my body. About this time a seaman came into the cabin with a light, and carried away an hour glass that hung upon a nail without observing me, though I made several efforts to attract his attention. Shortly after a pane in the skylight was broken by accident, and I saw the fragments of glass drop on the floor. These circumstances actually occurred, as I found on inquiry next day; and I mention them to prove that the sensations I describe were realities, and not the offspring of perturbed dreams. My inability to move was not accompanied with pain or uneasiness, but I felt as if the principle of life had entirely departed from my frame. At length I became totally insensible, and continued so till an increase of the wind made the sea a little rough, which caused the vessel to roll. The motion, I suppose, had the effect of awakening me from my trance, and I contrived some how or other to get up and go upon deck. My memory was totally lost for about a quarter of an hour, and I had no idea connected with any thing that was not present before me. I knew that I was in a ship, but nothing more. While in this state I observed a man drawing water from the sea in buckets, and requested him to pour one upon my head; after some hesitation he did so, and all my faculties were immediately restored, and I acquired a most vivid recollection of a vast variety of ideas and events which appeared to have passed through my mind, and occupied me during the time of my supposed insensibility. All this singular constitutional derangement had arisen from a copious inhalation of the fumes of tobacco; for on examining the cabin, I found that the piles of packages, there consisted of that narcotic plant, and that quantities of it lay even under my bed, in short that the sloop contained almost nothing else.—*Howison's Foreign Scenes.*

The Three Balls.—The three blue balls suspended from the doors or windows of pawn-brokers have been humorously enough described, as meaning that it was two chances to one that the things pledged should ever be redeemed; but in fact they are the arms of the Lombard merchants, who gave the name to the street in which they dwelt, and who were the first who publicly lent money on chattel securities.

Burying - Grounds.—The custom of burying dead persons in grounds set apart for that purpose was not established till the year 200. People before that time were interred in the highways, and ancient tombs are still to be seen in the roads leading to Rome. Hence these words so often repeated in epitaphs, " Sta, Viator,"—Stop, Traveller.

Church Bells.—The invention of bells, such as are hung in the towers or steeples of Christian churches, is, by Polydore, Virgil, and others, ascribed to Paulinus, Bishop of Nola, a city of Campania, about the year 400. It is said that the names Nolæ and Campanæ, the one referring to the city, the other to the country, were for that reason given to them. In the time of Clothair, king of France, and in the year 610, the army of the king was frighted from the siege of the city of Sens, by ringing the bells of St. Stephen's church. In the times of popery, bells were baptized and anointed, *Oleo Chrismatis;* they were exorcised, and blessed by the bishop, from a belief that when these ceremonies were performed, they had power to drive the devil out of the air, to calm tempests, to extinguish fire, and even to recreate the dead. The ritual of these ceremonies is contained in the Roman Pontifical; and it was usual in their baptism to give each bell the name of some saint. In Chauncey's History of Hertfordshire, page 383, is the relation of the baptism of a set of bells in Italy with great ceremony, a short time before the writing of that book. By an old chartulary, once in possession of Weever, the antiquary, it appears that the bells of the priory of Little Dunmow, in Essex, were, anno 1501, new cast, and baptised by the following names:—

> Prima in honore Sancti Michaelis Archangeli.
> Secunda in honore S. Johannis Evangelistæ.
> Tertia in honore S. Johannis Baptistæ.
> Quarta in honore Assumptionis Beatæ Mariæ.
> Quinta in honore Sancta Trinitatis, et omnium Sanctorum.
>
> Fun. Mon. 633.

The bells at Osney Abbey, near Oxford, were very famous: their names were Douce, Clement, Austin, Hautecter, (potius Hautcleri,) Gabriel, and John.—Appendix to Hearne's Collection of Discourses by Antiquaries, No. 11.

Near Old Windsor is a public-house, vulgary called the Bells of Bosely. This house was originally built for the accommodation of bargemen and others, navigating the river Thames between London and Oxford. It has a sign of six bells, i. e. the Bells of Osney.

In the Funeral Monuments of Weever are the following particulars relating to bells:

" Bells had frequently these inscriptions on them:

> " Funera plango, fulgura frango, sabbata pango.
> Excito lentos, dissipo ventos, paco cruentos."
> Page 122.

" In the little sanctuary at Westminster, King Edward III. erected a clochier, and placed therein three bells for the use of St. Stephen's chapel: about the biggest of them were cast in the metal those words:

> " King Edward made mee thirtie thousand weight and three;
> Take mee down and way mee, and more you shall find mee."

But these bells being to be taken down in the reign of King Henry VIII., one writes underneath with a coal—

> " But Henry the Eighth,
> Will bait me of my weight."—Page 492.

This last distich alludes to a fact mentioned by Stow in his Survey of London, ward of Farringdon Within, to wit, that near St. Paul's school stood a clochier, in which were four bells, called Jesus' bells, the greatest in all England, against which Sir Miles Partridge staked a hundred pounds, and win them of King Henry VIII. at a cast of dice.

It is said that the foundation of the fortunes of the Corsini family in Italy was laid by an ancestor of it, who, at the dissolution of religious houses, purchased the bells of abbeys and other churches, and by the sale of them in other countries acquired a very great estate. Nevertheless it appears that abroad there are bells of great magnitude. In the steeple of the great church at Roan, in Normandy, is a bell with this inscription:

> " Je suis George de Ambois,
> Qui trente cinqui mille pois;
> Mes lui qui me pesera,
> Trent six mille me trouvera."
>
> " I am George of Ambois,
> Thirtie-five thousand in pois;
> But he that shall weigh me,
> Thirtie-six thousand shall find me."
>
> Ibid.

And it is common tradition that the bells of King's College chapel, in the university of Cambridge, were taken by Henry V. from some church in France, after the battle of Agincourt. They were taken down some years ago, and sold to Phelps, the bell-founder, in Whitechapel, who melted them down.

The practice of ringing bells in change is said to be peculiar to this country, but the antiquity of it is not easily to be ascertained; there are in London several societies of ringers, particularly one called the college youths: of this, it is said, Sir Matthew Hale, lord chief justice of the court of King's Bench, was, in his youth, a member; and in the life of this learned and upright judge, written by Bishop Burnet, some facts are mentioned which favour this report. In England the practice of ringing is reduced to a science, and peals have been composed which bear the names of the inventors. Some of the most celebrated peals now known, were composed about fifty years ago by one Patrick: this man was a maker of barometers; in his advertisements he styled himself Torricellian Operator, from Torricelli, who invented instruments of this kind.

In the year 1684, one Abraham Rudhall, of the city of Gloucester, brought the art of bell-founding to great perfection. His descendants in succession have continued the business of casting bells; and by a list published by them, it appears that at Lady-day, 1774, the family, in peals and odd bells, had cast to the amount of 3594. The peals of St. Dunstan's in the East, and St. Bride's, London; St. Martin's in the Fields, Westminster; are in the number.

Corinthian Order. — A marriageable young lady of Corinth fell ill, and died. After the interment, her nurse collected together sundry ornaments with which she used to be pleased; and, putting them into a basket, she placed it near her tomb. Lest they should be injured by the weather, she covered the basket with a tile. It happened that the basket was placed on a root of *acanthus*, which in the spring shot forth its leaves, and these turning up the side of the basket, naturally formed a kind of volute, in the turn given by the tiles to the leaves. Fortunately, Callimachus, a very ingenious sculptor, passing that way, was struck with the beauty, elegance, and novelty of the basket surrounded by the leaves of the acanthus; and, according to this idea or example, he afterwards made columns for the Corinthians, ordaining the proportion such as constitute the Corinthian order.

NOTICES TO CORRESPONDENTS.

A Mechanic—R. B., Darvill—J. Whyte, Esadale—M. R.—Mechanic, &c. have been received. We shall be glad to hear again from C. D.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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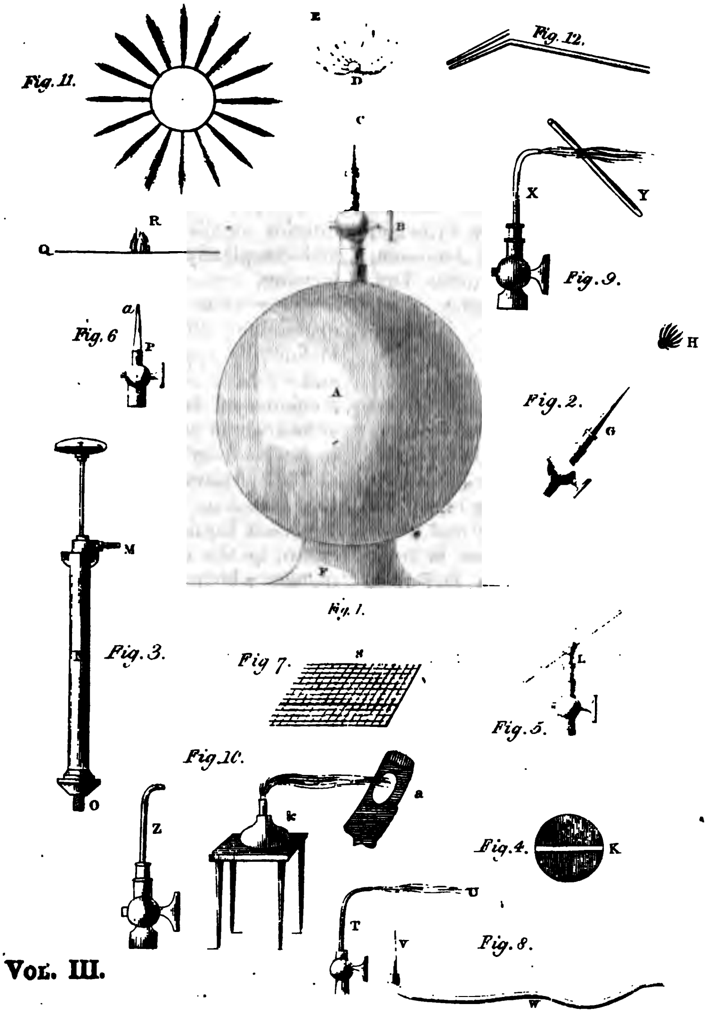
EXPERIMENTS WITH COMPRESSED GAS APPARATUS;

By John Deuchar, Esq. M. W. S., M. R. A. I., and Lecturer on Chemistry and Experimental Philosophy in Edinburgh.



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ACCOUNT OF SEVERAL EXPERIMENTS PERFORMED WITH A COMPRESSED GAS APPARATUS.

Being the Substance of a Paper read before the Werneriam Natural History Society, by John Deuchar, Esq. M. W. S., M. R. A. I., and Lecturer on Chemistry and Experimental Philosophy, in Edinburgh.

Edinburgh, 24th June, 1825.

GENTLEMEN,—Agreeable to your request, I now send you a brief sketch of my paper[*] regarding the various purposes to which we may apply an apparatus for holding condensed gas: but as, in a work such as the Glasgow Mechanics' Magazine, some of the details might appear tedious, I shall content myself in directing the attention of your intelligent readers to the most important only of the experiments, some of which I have, since the first reading of my paper in the Wernerian Society, had the honour to perform before Principal Baird, Professors Leslie, Jamieson, Russel, Grahame, and Ritchie, Drs. Barclay, Grant, Newbigging, Yule, and Knox, and other scientific gentlemen.

Experiment 1.—When a common brass blow-pipe nosle is put upon the top of the condensing-gas-holder, a mahogany ball (of the size shown in fig. 4,) will be supported upon the column of gas as it is allowed to escape; and when the ball is at the distance of from one inch to one and a half inch above the opening, we may inflame the gas, and still the ball will be supported, and perform a double rotatory motion in the centre of the flame (as shown in fig. 1.) Although this experiment be continued for five minutes, yet the wooden ball is not burned, nor even much warmed. In order to mark the motion of the ball, it has a white ring round it.

There are two causes which operate here in keeping the temperature of the ball below the point of combustion. The first is the hollow nature of flame; it is on the outer surface of the gas alone that the combustion takes place, for there only it has the necessary supply of oxygen to carry on its combustion; the interior, therefore, in which the ball is situated, consists of a mixture of the gas, partially scorched or converted into smoke, united with some that has not been at all changed. And, secondly, the rapid rotatory motion of the ball farther prevents the action of the interior uninflamed column of gas, and completely prevents the wood burning.

Experiment 2.—Repeat the last experiment, and, at the same time, incline the apparatus to one side, and we have the ball supported on a colume of flame obliquely, even at an angle of nearly 45°, (as shown in fig. 2,) from the perpendicular.

The inflammation of the gas, in this instance, shows how correct Professor Leslie's ideas were with regard to the nature of the phenomenon which he, I believe, first noticed, of a colume of air supporting a hollow brass ball at an angle of 45°; namely, that the ball was enveloped by a sheath of the air; and the inflammation of the gas renders so far unnecessary any mathematical demonstration with regard to that point.

Here is shown, in a very beautiful manner, the inflamed sheath of gas surrounding the ball, by the rapid motion and force of which it is that the ball is enabled to resist the power of gravitation even at the inclination of an angle of 45°; but when we slant the apparatus more to one side, we then find that the attraction of gravitation becomes stronger than the propelling force of the inflamed gas, and we see the ball drop through the burning sheath in which it was previously enveloped.

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[*] This Paper was read upon the 19th day of March, 1825, and the Experiments were at the same time performed before the Wernerian Natural History Society.

In alluding to the very curious observation of Mr. Leslie regarding common air, I cannot help stating, that, in the "Chemist," Volume I. page 381, it has, by misrepresentation, been attempted to make it appear, that the learned Professor had claimed the merit of discovering that a brass ball could be supported on a colume of water. Now, so far as my information goes, Mr. Leslie leaves the far less singular circumstance of a ball being supported on a perpendicular colume either of water or air, to be claimed as the discovery of those earlier philosophers, from whose ingenuity the Swiss and German schoolboys (of whom the Correspondent in the "Chemist" speaks so highly) had learned their amusing recreation; but the Professor deservedly, I think, is entitled to the merit of first proving that a brass ball could be supported upon a colume of water or of air, when that colume is inclined even to an angle of 45° from the perpendicular.

Experiment 3.—With regard to the utility of a compressed gas apparatus for lighting houses, I need say little, as Mr. Gordon has already extensively applied it in this way. For domestic purposes, it possesses various advantages over the ordinary fixed gas lights, and particularly in an ornamental way. From the greater pressure which we obtain, we can have upon the table various kinds of revolving lights; one of this description is represented in fig. 5, in which we have a tube turned round by the force of the gas as it escapes and strikes upon the external air: by screwing upon the top of the apparatus a flat gas burner, (such as the one shown in fig. 11,) we can have a kettle kept boiling, or a toast-dish kept warm, during breakfast.

Experiment 4.—Put a single jet burner on the top of the apparatus, and inflame it; now, place over the flame a piece of wire gauze, the meshes of which are about as fine as those in Sir Humphrey Davy's safety lamp, and we find that the flame does not pass through till the gauze is red hot; we thus also see the hollow nature of the flame.

Experiment 5.—Whilst a single jet is burning, as in the last experiment, slide the wire gauze close over the gas orifice, (at *a*, fig. 6,) and then elevate the wire gauze about one or two inches, and we have the gas burning above the wire gauze but not below; (see Q, R, fig. 6;) and, by moving the wire gauze up and down and sideways, we can make the flame move about at a distance from the apparatus.

In performing both of the two last experiments, I have often found the inflammation of the portion of gas at the opposite side of the wire gauze take place, although very unexpectedly; thus, when the gas is burning only above the wire gauze, if we try to put out the gas there, either by blowing upon it, or by moving the hand across it, sometimes the gas below takes fire even although that above is put out: the rapid motion of the wire gauze may also produce the same result.

In this last experiment, the higher up we hold the wire gauze, so much the more noise does the gas make in burning.

Experiment 6.—The compressed

gas apparatus may be used in four different ways, with great advantage, as a blowpipe. The first and simplest of these is, by charging the apparatus with common air, and using it in the same way as a double bellows blowpipe, either with a spirit or oil lamp. (See fig. 10.) And here it is to be remarked, that, as we can have a greater pressure, this mode is superior to the double bellows, or mouth-blowpipe.

Experiment 7.—The second mode of using this apparatus as a blowpipe, is by charging it with hydrogen, coal, or oil gas. We in this case only require to inflame the gas, and allow it to escape, with as much force as we can do without the risk of the velocity blowing out the flame. This is a very convenient blowpipe for working with glass. (See fig. 9.)

Experiment 8.—Thirdly, we may use the gas blowpipe along with a spirit or oil lamp, (as was explained in Experiment 6, and fig. 10.) By this mode we are enabled to produce a greater degree of heat than in Experiment 7, because we can allow the gas to escape more rapidly, from there being no risk of its being thereby extinguished.

Experiment 9.—Fourthly, we may employ this apparatus as a blowpipe to give a most intense heat, by compressing into one ball hydrogen, coal, or oil gas, and into another ball oxygen gas; these gasses may be made to issue through separate long bent nosles, brought near each other, as in fig. 12.

The great objection which has always presented itself to the use of the oxy-hydrogen blowpipes of Newman, Clarke, and others, was the risk of explosion; this danger has, however, it must be granted, been considerably obviated by the ingenious safety divisions proposed by Sir Humphrey Davy and Dr. Hope; yet still it cannot be called a safe blowpipe; and at the same time it did not admit of a charge sufficient for any lengthened experiment. Now, from two balls having the gasses compressed separately, there can arise no explosion; and, from the magnitude of the balls, we can have a greater supply of gas; we can allow it to escape more abundantly during the experiment; and we can thus obtain a far more intense temperature.

Experiment 10.—If the operator has only one condensing ball, then he may fix a flexible tube, coming from a gasometer containing oxygen gas, in such a manner that the oxygen as it escapes may intersect a stream of inflammable gas issuing from the compressed gas apparatus, as shown in fig. 8. Now, any small object to be operated upon, when it is placed where the two gasses intersect each other, will be exposed to a very powerful heat.

I am, yours, &c.

JOHN DEUCHAR.

Explanation of the plate.

Fig. 1, shows the condensed gas apparatus. A, is the body of the apparatus, about one foot in diameter; B, is the stop-cock to let out the gas when wanted; C, is a blowpipe nosle to let the gas escape in a small stream; D, is a mahogany ball, supported upon the inflamed gas, which forms a wreath of flame around it, as shown at E, (see Experiment 1;) F, is the support of the apparatus.

Fig. 2, represents the column of inflamed gas supporting the wooden ball, at an angle of nearly 45°; G, is the stop-cock and nosle at the top of the condensed gas apparatus; and H, the ball enveloped in flame.

Fig. 3, is a compressing syringe for forcing the gas into the apparatus; I, is its piston rod, and N, its barrel; M, is an opening upon which to fix the flexible tube coming from the gas-holder; O, is the screw which unites the syringe to the compressed gas apparatus immediately above the stop-cock, B.

Fig. 4, shows the exact size of the mahogany ball; K, is the white ring round it.

Fig. 5, is the stop-cock of the apparatus, with a revolving wheel, L, fixed to it, which moves perpendicularly.

Fig. 6, represents the flame cut off from the apparatus; P, is the stop-cock and nosle; *a*, the orifice of the nosle; Q, the wire gauze; and R, the flame cut off.

Fig. 7, S, is the wire gauze.

Fig. 8, shows the combined heating effect of a stream of hydrogen and oxygen gasses intersecting each other; T, is the stop-cock and bent blowpipe nosle; U, the gas, inflamed; W, a flexible tube conveying oxygen gas; and V, its blowpipe nosle.

Fig. 9, shows the use of inflamed gas as a blowpipe; X, is the stop-cock and bent nosle with inflamed gas; and Y, is a glass rod in the act of being melted thereby.

Fig. 10, shows the use of compressed air as a blowpipe; Z, is the stop-cock and bent blowpipe nosle, from which air is issuing; "&" is a spirit lamp; and *a*, a lump of charcoal, on which is placed the substance to be acted on.

Fig. 11, is a flat gas burner, to set a pot, kettle, or any other vessel upon, to boil.

Fig. 12, shows how the two bent tubes, coming from two compressed gas apparatus, may be brought together when we wish to use oxygen and imflammable gasses in separate vessels.

LITERARY AND SCIENTIFIC INSTITUTION AT THE UNIVERSITY PRINTING OFFICE, GLASGOW.[*]

We were certain that the excellent plan of self instruction adopted at the Glasgow Gas Work, under the superintendence of Mr. Neilson, required only to be known to be speedily followed by others; and this was shown by the effect produced by the publication of Mr. Bannatyne's able appeal to the masters of public works. It was very shortly after in our power to notice the commencement of several Institutions of the same kind, both in our own neighbourhood and in other parts of the country, and among these, one at the University Printing Office. A very sensible pamphlet has just been published by Mr. M‘Conechy, Surgeon, (who appears to have interested himself considerably in the originating of this Institution,) giving an account of the Institution, and containing the address delivered by him at its opening, and the reply made by the President. From this pamphlet it appears that there are from ninety to ninety-five men and boys employed at the University Printing Office, and of these there were, in March last, 54 subscribers to the library, which had been instituted about twenty months before that time, by a donation of books from

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[*] An Introductory Address, delivered on the 19th of March, 1825, on the Formation of a Literary and Scientific Institution among the Workmen of the University Printing Office, Glasgow; with an Account of the Institution, and some Preliminary Remarks on Popular Education, by James M‘Conechy, Esq. Surgeon. With a Reply to the Address, by James A. Begg, one of the Workmen. Glasgow: Wardlaw & Cunninghame, 173, Trongate. 1825.

Mr. John M. Duncan. It now contains 210 volumes, consisting principally of historical works, travels, romances, and poems. The entry-money is 1s. 6d. to a journeyman, and to an apprentice 6d. for the first year, and 1s. for the second, in order that it may be as little burdensome as possible. A fund for the purchase of books is collected in the following manner:—The establishment is divided into three *Chapels*, as they are technically called, which are associations of the different orders into which the men are separated, *viz.* the readers, or correctors of the press, the compositors, and the pressmen. A boy, on joining the office as an apprentice, pays 5s. of entry-money, which is levied by instalments; and a journeyman, under similar circumstances, pays 2s. 6d. The money thus collected, together with fines for petty delinquencies, levied by the workmen from each other, is called the *Chapel Fund*, and was *formerly disposed of in merry meetings, and social parties;* since the institution of the library, however, it is otherwise applied, *and is now exclusively used in the purchase of books.* This is the principal source of revenue; but as the most considerable part of it must, obviously, fluctuate according to the number of admissions, it has been thought prudent to have a less variable fountain of income. Accordingly, it was agreed that the monthly contribution to the library should be 4d. for a journeyman, 2d. for apprentices of the first year, or who do not make *premium*, and 3d. for apprentices farther advanced.—Whenever the chapel funds are inadequate to supply the full amount of this subscription, the deficiency is made up by a proportionate sum, levied from each member. Should there be at any time a surplus of entry-money, which is not likely frequently to happen, it is left to the disposal of the different chapels.

Of the 54 persons who subscribed to the library, 17 only were journeymen; the rest were apprentices from 14 to 21 years of age, a circumstance which may be satisfactorily explained by stating, that many of the men read steadily in other libraries, unconnected with their own establishment, as the Mechanics' Library, Anderson's Institution Library, and the North Quarter Library, where they have a greater choice of books.

Such was the state of things, it seems, at the University Printing Office till the spring of the present year, when, as naturally connected with the library, Mr. Duncan proposed to establish a scientific and literary institution, on the principle suggested by Mr. Neilson of the Gas Establishment. The proposal was highly relished by the majority of the workmen, who immediately set about the necessary preparations; and, on the 19th of March, the Institution was opened by the Introductory Address which is now submitted to the public. At first some of the subscribers to the library demurred at a union with the institution, which they looked on as an experiment of whose success they were somewhat doubtful. These scruples are now happily removed, and the library and institution are fairly and firmly joined.

The Institution consists at present of seventy-two members, and is managed by regular office-bearers: a president, secretary, and treasurer, who are chosen by ballot. It is proposed that a small fund for its support shall be created by a contribution on the members who join, the amount of which is not yet fixed on. The meetings are weekly, and have hitherto been held in a school-room, rented for that purpose by the members: it is, however, the intention of Messrs. Duncan to make some addition to their premises, and to give them, if possible, a room for their express use, with a furnace, and other conveniences, for chemical experiments. The attendance has hitherto been very full, and as tickets of admission are issued, and must be shown at the door, all confusion is thus guarded against. The individuals comprising the committee were requested, at the opening of the Institution, to take on themselves the duty of lecturing, a subject being prescribed to each of them. Ten lectures have been already delivered, and it is now proposed to suspend the meetings during the summer months, that leisure may be afforded to those who may have to lecture next winter, for the collection of materials. A list is subjoined of the subjects treated of, with the names and designations of the lecturers.

LECTURES.

I. Mechanical Properties of Matter, Extension, Impenetrability, Divisibility, Elasticity, Mobility, Weight, Inertia, Attraction, and Repulsion.

II. & III. Chemical Properties of Matter, Chemical Affinity, Caloric, its nature, effects, Expansion, Fluidity, Instruments for measuring Heat, Thermometers, Pyrometers.

IV. Motion, Uniform Motion, Measures of Motion, Laws of Motion, Communication of Motion by Impulse, Accelerated or Retarded Motion.

V. Simple Substances, Atmospherical Elements, Oxygen, Nitrogen.

VI. Centre of Gravity, Mechanic Powers, or Simple Machines, Levers.

VII. Simple Substances continued, Elements of Water, Oxygen, Hydrogen.

VIII. Mechanic Powers continued, Wheel and Axle, Inclined Plane, Pully, Wedge and Screw.

IX. Simple Substances continued, Sulphur, Carbon, Phosphorus.

X. Hydrostatics, Pressure and Equilibrium of Fluids, Hydrostatic Paradox, Specific Gravity of Fluid and Solid Bodies.

LECTURERS.

James A. Begg, Pressman, President of the Institution. Adam Aitchison, Overseer of the Press Room. Thomas Orr, Corrector of the Press. George Brookman, Corrector of the Press. Malcolm Wright, Corrector of the Press. Alexander Whitelaw, Corrector of the Press. Alexander Spears, Corrector of the Press. Robert B. Townshend, Compositor. Daniel M'Donald, Pressman. David Mowat, Pressman.

The sketch now given of the proceedings of the workmen at the printing office, will serve effectually, it is to be hoped, to remove all doubt about the propriety of encouraging the formation of similar institutions in other large establishments. As an evidence of their usefulness, it may be remarked, that one of the men who delivered a lecture on Hydrostatics, a subject which was prescribed to him by his associates in the committee, *did not know, when it was proposed to him, what the* WORD MEANT! yet he delivered an interesting and respectable lecture, and went through his experiments with very considerable ease and accuracy. This fact, so creditable to the individual himself, we have great pleasure in recording, and we think it may be successfully opposed to any given number of speculative objections on the advantages of encouraging scientific inquiries among the most ignorant of the operatives. The majority of the committee who lectured are intelligent and well informed men, and had, with a few exceptions, given more or less attention to philosophical subjects. Most of them had attended several sessions at Anderson's or the Mechanics' Institution, and were, consequently, aware of the importance of scientific knowledge; yet they with one voice agree in declaring, that the advantages which they derived from being obliged to prepare written lectures, were very great, Mr. John M. Duncan. It now contains 210 volumes, consisting principally of historical works, travels, romances, and poems. The entry-money is 1s. 6d. to a journeyman, and to an apprentice 6d. for the first year, and 1s. for the second, in order that it may be as little burdensome as possible. A fund for the purchase of books is collected in the following manner:—The establishment is divided into three *Chapels*, as they are technically called, which are associations of the different orders into which the men are separated, *viz.* the readers, or correctors of the press, the compositors, and the pressmen. A boy, on joining the office as an apprentice, pays 5s. of entry-money, which is levied by instalments; and a journeyman, under similar circumstances, pays 2s. 6d. The money thus collected, together with fines for petty delinquencies, levied by the workmen from each other, is called the *Chapel Fund*, and was *formerly disposed of in merry meetings, and social parties;* since the institution of the library, however, it is otherwise applied, *and is now exclusively used in the purchase of books.* This is the principal source of revenue; but as the most considerable part of it must, obviously, fluctuate according to the number of admissions, it has been thought prudent to have a less variable fountain of income. Accordingly, it was agreed that the monthly contribution to the library should be 4d. for a journeyman, 2d. for apprentices of the first year, or who do not make *premium*, and 3d. for apprentices farther advanced.—Whenever the chapel funds are inadequate to supply the full amount of this subscription, the deficiency is made up by a proportionate sum, levied from each member. Should there be at any time a surplus of entry-money, which is not likely frequently to happen, it is left to the disposal of the different chapels.

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LIVERPOOL MECHANICS' INSTITUTION.

We formerly noticed that a meeting had been advertised for the purpose of originating a Mechanics' Institute at Liverpool. Since that time the meeting has taken place, a committee has been appointed, and we have no doubt that very shortly Liverpool will receive as much honour from its Mechanics' Institute, as it has done from its other numerous efforts to promote education and a love of reading among mechanics. We were much pleased with the following letter from Mr. Huskisson. It shows how differently men in power now view the education of the people, from what they did a short time ago.

Somerset-Place, 21st May, 1825.

Sir,—I have to acknowledge the receipt of your letter of the 17th instant, in which you state that, as Chairman of a meeting lately held at Liverpool, you have been requested to express the wish of that meeting, that it might consist with my public duties, and private convenience, to take the chair at a general meeting of the inhabitants, proposed to be held, for the purpose of taking into consideration the expediency of forming a Mechanics' Institute in that town.

I have no difficulty in stating, that I consider Institutions of this nature as likely to be attended with beneficial results both to artizans and the public, if properly regulated, and directed to those objects to which such Institutions ought, in my opinion, to be limited; I mean, to the teaching of such branches of science as will be of use to mechanics and artizans in the exercise of their respective trades. It is under this feeling, and with this view, that I have taken an interest in the society originally formed at Edinburgh, for the education of mechanics, under the title of "The School of Arts," the regulations and proceedings of which I would take the liberty to recommend to your notice.

I regret, however, to say, that, from the present state of public business, and the avocations which are likely to press upon me after the session of Parliament, I see no chance of having it in my power to name any time when I could go down to Liverpool. I must, therefore, beg permission to decline the honour proposed. In doing so, I cannot refrain from expressing how much I am gratified by the liberal view which you take of the individual efforts of his Majesty's Ministers to foster the arts, and to promote the general diffusion of knowledge; as well as by the considerate and friendly motive which induces you to urge the flattering request of the meeting over which you presided.

I have the honour to be,
Sir,
Your most obedient humble servant,
W. Huskisson.

Samuel Hope, Esq. Chairman, &c. &c.

M. DUPIN'S ADDRESS TO THE MECHANICS OF PARIS,

Delivered in November last, at the Conservatoire Royal Des Arts et Metiers.

[In No. LXXII. of our present Volume, we mentioned that, at Paris and Lyons, Mechanics' Institutions had been commenced, and were likely to prove as beneficial as they had done in Britain. The following masterly discourse was delivered by Charles Dupin, the enlightened scientific and practical Engineer, at the Mechanics' Institute at Paris, as an introduction to a new course of Lectures on Geometry and Mechanics applied to the Arts.]

GENTLEMEN,—When the Sciences were first cultivated, they were kept separate from the common purposes of life: inclosed in the studies of a few men of leisure, they appeared only as speculations, entirely foreign to the necessities of existence, and to the wants of the arts.

From this moment an opinion was formed, that the sciences had nothing in common with the labours of industry, and that theoretical views could not become of any utility, not to the simple workman merely, but even to the directors of manufactories.

It must also be allowed, that the abstract and difficult appearance of the explanations and demonstrations — the strange appellations given to things which ought to have been designated with the greatest possible simplicity, and which have been obscured by Latin, Arabic, and Greek names, have all contributed to render the sciences unintelligible to men who had not engaged in other studies.

From these circumstances arose the belief, that the sciences could not be put within the reach of men occupied by manual operations, and more habituated to the exercise of their limbs than to the cultivation of their minds.

I shall attempt, gentlemen, to prove, on the contrary, that it is possible to reduce the useful parts of science to the language that we employ for the expression of our most simple ideas.

Together with each principle that I shall present to you, I shall set also before you the services which it is capable of rendering, and which in reality it does render; the application even which you often make of such principles without being aware of it.

Often, gentlemen, I shall show you, that you are already acquainted with that which I am to teach you; and that in your most complicated labours, you obey instinctively, or by observation, or by the nature of things, the rules which science imposes.

Do not conclude, however, from this statement, that you will gain nothing by knowing the clear, defined, and exact expression of these principles: you would fall into a serious error by adopting this conclusion.

The principles of science are truths reduced with exactness into the smallest possible number of words; truths which express the necessary relation existing between the objects of our conceptions, or of our labours.

Each of these truths is susceptible of an immense number of applications; and the mode of making these applications is of primary importance. By this knowledge, in all new cases which present themselves to you, you will know before hand what will be the most advantageous to put in practice; consequently, you will not be obliged to explore, to make trials, and to waste your time and your materials: you will possess a faithful guide, which will direct you to act better, and to act more surely.

Mechanics, as I ought to teach them in this course, is not merely the science which explains the operation of machines properly so called;—it explains the rules and the laws of every action in which force is employed, whether great or small: of every action in which motion occurs, whether slow or rapid.

As there can be no labour without motion, and without force, you see already, that every sort of labour, applied to every profession, enters into the sphere of mechanics.

Thus we shall explain the principles and the rules which regulate the action of machines, the action of instruments, and of the limbs of man, the most precious instruments with which nature has endowed him.

Perhaps you may offer to me a very natural objection against this design,—Will a professor pretend to teach us how to work, who is a stranger to each of our professions? Will he teach us to hold our tools properly, and to manage them adroitly, who perhaps could not make the most simple article which we produce?

These are manual processes, which each of you can put in practice much better than I can; and so far from wishing to teach you these, it is from you I would seek instruction, if I wished to practise them.

But there are general methods of improving your labours, which do not depend upon any art in particular; methods which it is important for you all to know, and of which a part only is known by each of you. These are the methods of which a professor must take advantage in order that you may be able to execute in perfection the products of industry. They will accordingly furnish the materials of my course of lectures.

Ought these products to have a certain figure, determined before hand, a fixed size, or weight, or indispensable proportions, &c.? You must, in the first place, take the measures; you must take them in length, in breadth, and in thickness: in many directions, parallel, oblique, or perpendicular. You work from a model: but sometimes this model is less, sometimes it is greater than the object to be produced: here are reductions to be made, and science gives you the means of making them.

You see already, gentlemen, that in order to execute the work which has been ordered, you ought to have very exact measures: you ought to know the divisions and the use of the metre, of the litre, of the kilogram, &c. I shall explain to you these measures, their use, and the advantages as to facility and uniformity which they present.

Some notions of elementary geometry are necessary, in order to take these measures, and to refer them from an object to a plane, and from a plane to an object. Some other geometrical notions are necessary to comprehend the form of certain products of industry, and the action of machines. I shall explain those which appear to me to be indispensable.

If in the arts every thing were done with the rule and the compass, this knowledge of measures and of geometry would be sufficient. But there are many forms which cannot be thus traced by a mechanical motion. Such are the outlines of vases, the ornaments of some friezes, and some mouldings in architecture; such also are the trees, flowers, &c. which are to be printed, engraved, or sculptured, upon wood, metal, stuff, and the like.

The tracing of these objects requires a knowledge of drawing, which refers sometimes to figure, sometimes to ornament, and sometimes to landscape, according to the nature of the subjects which the artist wishes to represent.

In all these kinds of drawing, there are means of perfecting the eye by the hand, and the hand by the eye; means which are valuable to the artist. These we have studied, and shall attempt to explain them to you.

Hitherto, gentlemen, we have been engaged only with the preparations for the labour employed to execute the products of industry. This labour operates sometimes with the force of machines, sometimes with the force of the workmen, and generally with the two forces combined.

Labour which operates without instruments, is the most confined. Such is that of the porter, who carries burdens upon his head, or his shoulders. Such is that of the baker, who kneads the dough with his hands: of the peasant, who presses the grapes with his feet.

This part of the arts is the most limited in the circle of its occupations: it requires the least intellect, whilst it requires the greatest exertion of our purely animal force. For this reason, the professions which are thus exercised, are regarded as the lowest species of human industry.

Here, gentlemen, I must make you understand, how decidedly mechanics is a friend to workmen. Its object is to disencumber them of those overwhelming labours, in which man can only perform the part of a horse, of an ass, or of an ox, to drag, or to carry burdens. It is successfully occupied in finding, in behalf of the industrious man, less degrading labours, where the powers of the mind and of the body mutually assist and succour each other.

Let us compare, for example, two great cities; the one where the inhabitants can procure water only by means of water-carriers: the other which obtains it by conduit-pipes and aqueducts, by steam-engines, and other similar means.

In the first town, a great number of men must be employed, to carry the water in vessels which are inconvenient, from the river to each house. The carrier will soon have recourse to mechanics to assist him a little. He will get two pails of equal size, suspended on each side of a hoop: this hoop keeps them in equilibrio, by means of a rope, which passes over the shoulders. In this manner, he will carry the two pails with less trouble than he could carry a single pail, holding it by the handle. In fact, if he were not to use the hoop, he would be obliged to make painful efforts in keeping his arm out of the vertical position, in order that the pails might not strike his legs, by the effect of their weight; the hoop takes off the inconvenient pressure of this weight, by adapting it to the walk of the carrier.

We see already how this labourer can double the quantity of water which he furnishes to his customers, by merely making use of a hoop and a cord. The assistance of machines enables him to obtain much greater results. Let him employ a butt holding thirty-two, or thirty-six times as much as his pail, and let him place it upon a little cart. Thus, without greater labour, he will be able to transport from sixteen to eighteen times as much water through the town, as with the cord and the hoop; and from thirty-two to thirty-six times as much as with a vessel held in the hand. Surely, it appears to me, that a great benefit is here obtained by the use of the most simple of machines.

The water-cart, however, will only serve to bring the water to the doors of the houses. How severe and fatiguing is the operation of carrying two pails up the stairs, and conveying them to the highest floor, in a town where there are seven and eight stories besides the ground floor?

Let us now transport ourselves into the town where the water is elevated to the top of the houses, by the means furnished by hydraulics, that is to say, by that part of mechanics in which water is employed.

I see the occupation of many thousand men, before employed as beasts of draught or burden, changed for an occupation much less degrading, and giving employment to a multitude of able artizans.

The bricklayers, the masons, the carpenters, the engineers, execute the canals and the aqueducts necessary for bringing the water to the town. The miners, the founders, the plumbers, prepare, lay down, and solder together, the pipes of wood, of iron, and of lead, which are to distribute the water. Lastly, inspectors to survey the distribution, and men whose only labour is to turn cocks at certain hours of the day, take the place of the carriers, and obviate the necessity for their overwhelming labour.

If the water of the canals, and the aqueducts is not naturally sufficiently high, pumps must be constructed to raise it higher: but, instead of fatiguing men by turning in a circle, like the slaves in the time of the Romans, steam-engines are erected; workmen are employed either to take care of the fire, or to turn occasionally some cocks: by these easy and unlaborious occupations, they regulate with facility the greatest mechanical force.

[To be continued.]

LETTERS AND QUERIES.

ON DRAINING OLD WASTES IN COAL MINES.

Gentlemen,—In No. LXXVIII. of the present Vol. of your Magazine, I observe an attack upon me by A. K. J., without a hint from you on his severity, nor what is worse—his want of candour; indeed for his severity I care nothing, provided it was founded on truth. In my first letter on draining wastes, I said plainly that I was unacquainted with coal working; in my second, on the same subject, No. LXXV., to remove some mistakes, I stated my knowledge of what is called the dip of coal, and the inclination of the strata of the earth in general. Is this pretending to know the theory of coal mining, as A. K. J. says in his outset? The case this writer selects to overthrow the use of a syphon may sometimes occur in practice, for ought I know, but surely those who would convey the water running out at the mouth of a coal pit, to the bottom of another, and then pump it up again, could have little to boast either of knowledge or economy. It will be obvious to every candid reader, that, by the surface of the water, I understood the water in the body of the waste; beside which, that in a pit, though it were full, would be like a drop in the bucket; but this pitful, though small in quantity, would be tremendous in its effects; for, if 30 fathoms deep, it would exert a pressure of about 45 tons against every square yard of the mine below; and if there is such a thing as working at an uncertain distance from a mine so charged, or venturing to make an opening into it however small, it is surely the extreme of ignorance or fool-hardiness. In such a case, it would certainly be most rational to draw off the water by the old pit, either by an engine on a temporary erection, or by pipes leading to the engine of the going work, which, by a simple contrivance, might pump the new and old mines alternately.

A. K. J. acknowledges that there are other cases more favourable to my plan, but still he is determined to have nothing to do with it, but to let it *run*; but neither I nor the syphon need run far for all that Mr. A. K. J. has said, even with his *we* at his back, by which I presume he means the Colliers' Association.

Yours, &c.

G. M.

Glasgow, 20th June, 1825.

P. S.—The above Number contains another letter on the same subject, by L. M.; it is more civilly written, but turns wholly on the same point, *viz.* the old mine being full of water to the pit mouth: the only case that either writers could discover in which the syphon could be inapplicable, and that only till the water in the pit is reduced to the level of the roof of the old waste; and I think I have above shown both the danger and want of economy there would be in letting such pitful of water into the working mine by any means whatever.—G. M.

QUERY.

I have often seen, during warm weather, balls about the size of small shot on the bottom of shallow fresh and salt water, on solid rock, sand, and moss bottom, and if the water was agitated, they rose to the top: how came they to be formed there, or how do they stay at the bottom when air is so much lighter than water?

J. W.

MISCELLANIES.

Matter.—When wise men are asked, what is the soul? they answer, that they know not. If they are asked, what is matter? they make the same reply. It is true, that there are professors, and particularly scholars, who know all this perfectly; and when they have repeated that matter has extent and divisibility, they think they have said all: being pressed, however, to say what this thing is which is extended, they find themselves considerably embarrassed. It is composed of parts, say they. And of what are these parts composed? Are the elements of the parts divisible? Then they are mute, or they talk a great deal; which are equally suspicious. Is this almost unknown being called matter, eternal? Such was the belief of all antiquity. Has it of itself active force? Many philosophers have thought so. Have those who deny it a right to deny it? You conceive not that matter can have any thing of itself; but how can you be assured that it has not of itself the properties necessary to it? You are ignorant of its nature, and you refuse it the modes which nevertheless are in its nature; for it can no sooner have been, than it has been in a certain fashion—it has had figure, and having necessarily figure, is it impossible that it should not have had other modes attached to its configuration? Matter exists, but you know it only by your sensations. Alas! of what avail have been all the subtleties of the mind since man first reasoned? Geometry has taught us many truths, metaphysics very few. We weigh matter, we measure it, we decompose it; and if we seek to advance one step beyond these gross operations, we find ourselves powerless, and before us an immeasurable abyss.—*Voltaire.*

Gunpowder was invented by Berthold Schwartz, a monk, at Goslar, in Saxony, Anno Domini 1330, ten years after which Schwartz died. In fabulous history its origin has been assigned to Licinius Cacus, a Roman of celebrity in the early annals of Spain, where gunpowder was used within fourteen years of its discovery, and in England, not till the year 1418. The knowledge of gunpowder is lodged with the Chinese, and the oriental tribes of Calmucks have possessed the same art for time immemorial.

NOTICES TO CORRESPONDENTS.

Z. Z. Z., φ. β., &c. &c. have been received.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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" He who questioneth much shall learn much; and he whom he questioneth shall likewise gain knowledge."

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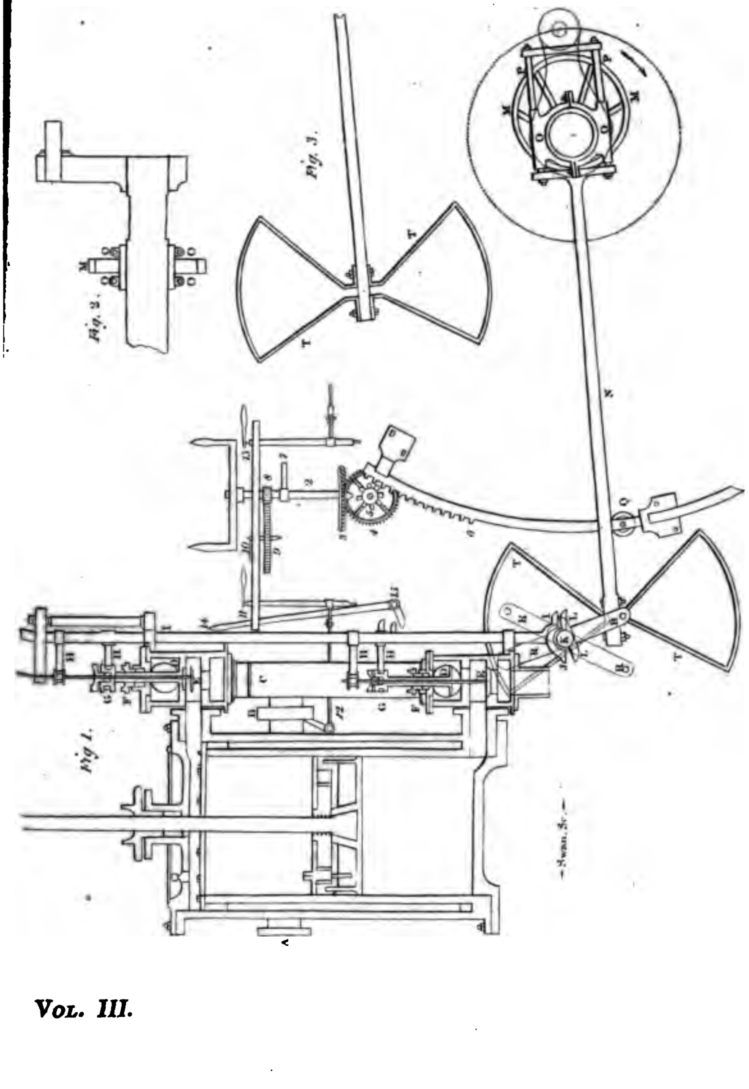
NEW AND COMMODIOUS METHOD OF REGULATING THE MOVEMENTS OF STEAM VESSELS.



ACCOUNT OF A NEW AND COMMODIOUS METHOD OF REGULATING THE MOVEMENTS OF STEAM VESSELS. By Messrs. JAMES and CHARLES CARMICHAEL of Dundee.

(In a Letter to Captain BASIL HALL, R. N., F. R. S. L. & E.) *

DUNDEE, 20th May, 1825.

SIR,—In compliance with your request, we forward you a sketch of the machinery of the George IV. Twin Steam-Boat employed on this ferry, and we shall now proceed to give a description of that part of it invented by ourselves, the utility of which you have frequently witnessed, and which you are pleased to think may not be uninteresting to the scientific public.

The object of the contrivance we are about to describe, is to regulate the motions of the steam-vessel in a more easy manner than heretofore. By the simple motion of a small handle, or index, placed on a table upon deck, in view and in hearing of the man at the helm, and of the master of the vessel, every movement which the engine is capable of giving to the paddle-wheel may be at once commanded. The vessel may be moved forwards or backwards—or may be retarded, or entirely stopped—at any given moment, by merely turning the handle to the places denoted by the graduations of a dial-plate. No skill is required for this purpose, so that the master himself, or a sailor under his directions, can perform the office as well as the ablest engineer. Thus, the confusion which frequently arises at night in calling out to the engineer below, is avoided, and any ambiguity arising from the word of command being transmitted through several persons entirely prevented. In point of fact, it places the engine as much under command as the rudder is—an undoubted improvement upon the clumsy method of bawling out to the engineer below, who either may not hear, or may chance to be out of the way,—circumstances which may lead to the most serious accidents.

The different parts of the machinery are not exactly arranged in the sketch as they are executed in said boat, but we hope that the principle will be better understood from having arranged them so as they can be better seen in the plate, fig. 1.

The cylinder and jacket are cast in one piece, connected at the bottom, but altogether disconnected at the top when cast; the vacancy between the two is closed at the top by an iron ring, and hemp or rust packing in the joints. The steam from the boiler enters between the cylinder and jacket by the branch A, passes round the cylinder, and communicates with the side-pipe C of the valve-chests by the branch B, but cannot enter the cylinder when the steam-valves D D are shut. The eduction-valves E E are situate below the steam-valves.

The steam-valve rods work through a flax packing at F F, and are made hollow, to allow the eduction valve-rods to pass up the centre of them; they are also made air-tight by a flax packing at G G.

The valve-lifters H H H H, are fast upon the lifter-rods I J, only

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* This Letter was published by Captain Hall in the Edinburgh Journal of Science; and also in a separate Pamphlet, one of which he has kindly sent us. As the improvement seems to be one which will be of considerable utility, we are happy to give it a place for the information of our readers.

which can be properly seen;
ot of the one farthest from
e is seen at the rocking-shaft.
of these rods lifts the upper
-valve and lower eduction-
and the other the lower
-valve and upper eduction-
The lower steam-valve and
eduction-valve are represent-
lifted in fig. 1.

rocking-shaft K, turns and
s upon its centre about 40°,
ving two spanners (or pallets)
jecting from it upon opposite
cause the lifter-rods and the
connected with them to rise
tely. The lifter-rods fall by
own weight, and when the
are horizontal, all the valves
ut, and for an instant of time
rest.

rocking-shaft receives its
from an eccentric-wheel M,
ed on the crank-shaft. The
of this wheel with relation to
ank and valves, is a point of
erable nicety, as upon this
ds the opening and shutting
valves at the proper time.

eccentric-rod N, is support-
the crank-shaft by a project-
rt on each side of the eccen-
heel, turned concentric with
haft by the brass pieces O.
our rods P, pass through these
pieces, and slide freely in
This part is shown in the
n at fig. 2, with part of the
(or paddle) shaft, and the
on one end. The other end
eccentric-rod is supported on
oller Q; and as the crank-
turns round, the eccentric-
avels backwards and forwards
ance equal double the eccen-
heel; and as the said rod is
cted with the rocking-shaft
double-ended spanner R R
e end of it, consequently the
g-shaft will travel from one
nity of its arch of motion to
her, in the same time that the crank-shaft makes half a revolution, or in the same time that the steam-piston travels from the top to the bottom of the cylinder, or from the bottom to the top. The steam-piston is represented in the middle of the cylinder, and as the lower steam-valve and upper eduction-valve are open, the piston must be ascending, and as the crank is connected with the opposite end of the walking-beam (or lever,) the crank will be descending. By the time that the piston has reached the top, and the crank the bottom, the rocking-shaft will be in that position where the pallets upon it are horizontal, and, of course, all the valves will be shut. But the momentum of the paddle (or fly) wheel carries on the motion, and immediately the two valves that were formerly shut, *viz.* the upper steam-valve and lower eduction-valve, are opened, and the steam presses down the piston with a force equal to the difference between its own elasticity and the elasticity of the uncondensed vapours below the piston. Thus the engines will continue to go, and the paddle-wheel to turn in the direction of the dart.

But that we may endeavour to explain to you the method of stopping or reversing the motion of the paddle-wheel, all that is necessary is to shut all the valves; and this is effected by disengaging the eccentric-rod from the spanner of the rocking-shaft, and the valves all shut of their own accord, by the weight of the valves, lifter rods, &c. and the engine will stand: and to set the engine agoing, either the one way or the other, is to lower the eccentric-rod, to take hold of the double-ended spanner on the end of the rocking-shaft, as represented on the sketch, and then the paddle-wheel will move in the direction of the dart, or lift the eccentric-rod to the top of the spanner on the rocking-shaft, and then the paddle-wheel will move in the opposite direction. The use of the sector-formed appendages T, on the end of the eccentric-rod, is to conduct the pins on the ends of the double-ended spanner into the notches adapted for them on each side of the eccentric-rod. The form of which is better seen detached, at fig. 3.

The hand-gearing, for starting or stopping the engines, is situated upon the deck of the boat, and all concentrated upon the top of a small table in view and in hearing of the man at the helm, or the master, who directs both, when coming to the quay.

1, a double-ended handle, which is upon the upright shaft 2, on the lower end of which is a bevel-wheel 3, working into another wheel 4; this wheel is on a lying shaft, which extends from the one engine to the other, and carries on each end of it a spur-pinion 5, which pinion works into the rack 6. There is a similar rack connected with the eccentric-rod of the other engine, into which the other spur-pinion works, so that, by turning the handle 1, both engines can be started, stopped, or reversed, with the greatest facility and certainty that could be wished for. These bevel-wheels, spur-pinions, and racks, must be so proportioned to one another, as that two complete turns of the handle 1, raises the eccentric-rod from the lowest to the highest position. One turn of the handle raises or lowers the eccentric-rods into the stopping position, and one turn, either the one way or the other, as circumstances require it, sets the boat ahead or astern. There is a projecting piece 7, fixed upon the upright shaft, which catches into a notch, pressed by a *spring, which* supports the racks and eccentric-rods, at any of the three positions that may be required.

As the said upright shaft makes two turns, and always stops at the same point, it is not suitable for the index. To remedy this, there is a small pinion 8, below the table, working into a wheel 9, with four times the number of teeth, for carrying the index 10. This wheel, making but half a revolution for two revolutions of the upright shaft, makes the index upon its arbour stand fore and aft when the engines are going, and thwart ships when the eccentric-rods are set in the standing position.

The index 11 is connected with the regulating-valve 12 by rods and spanners, and turned by hand, as circumstances require.

The index 13 is connected with the injection-cock by rods and spanners, it being always shut before the engines are stopped, and opened when the engines are started. Each engine has separate gearing for the regulating-valves and injection-cocks, and graduated circles on brass plates, to show, by inspection, the position in which they are standing.

When the engines stand for some time, it is necessary to let the steam pass freely through them for two or three seconds, on purpose to heat them, and expel any air that may have got inside. For this purpose, the long handle 14, standing by the side of the table, is fixed to a shaft 15, which goes across the front of both engines, and by four short spanners (or pallets) upon it, lifts all the valves of both engines, and allows the steam to pass freely through them by the air-pump valves. The engineer knows by the sound, when to replace the handle in the position shown in the sketch; and having previously set the index for the head or stern motion in the direction wanted, and adjusted the steam regulating index, the last thing he has got to do is to open the injection-cocks, and immediately the engines start in the direction wanted.

Thus we have, at your request, endeavoured to sketch and explain to you such parts of the ferry twin-boat, George the Fourth, of this place, as you more particularly wanted information respecting.—We hope that it is done in such a way as you will understand it; but if any further explanation is wanted, be so kind as write us.

We are, Sir, your very obedient Servants,

Jas. & Chas. Carmichael.

ON THE MEANS AFFORDED BY THE PENDULUM OF MEASURING THE FORCE OF GRAVITY.

Gravity is that force by which all bodies are continually urged towards a centre. At first view, one would imagine that the fall of bodies would be the same in all parts of the earth. This, however, we know is not the case; and the variation has been ascertained from voyages made for astronomical purposes, to be owing to the figure of the earth, which is nearly spherical, and to the difference of the centrifugal force in different degrees of latitude.

This power acts upon all bodies in proportion to their masses, and tends to impress upon them equal velocities in equal times. But we find that as we proceed from the poles to the equator, a diminution in the force of gravity takes place. To discover, therefore, an instrument capable of measuring the intensity of gravity in different situations, and at different parts of the earth's surface, was a desideratum. It was found impracticable to do this by means of the common balance, on account of the variations affecting equally the body which is weighed, and the weight to which it is compared.

The pendulum was, therefore, resorted to, and was found exactly to answer the purposes required, because its oscillations are accelerated or retarded by the minutest alteration in the force of gravity; and these retardations or accelerations, being accumulated by repeated oscillations, render the slightest deviation perceptible, by means of a corresponding effect being produced in the clock to which the pendulum is attached.

This instrument, the application of which to clocks has greatly promoted the progress of astronomy, consists of a body suspended at the end of a thread or road, moveable round a fixed point placed at the other extremity. The instrument, if once moved out of its perpendicular situation, and then abandoned to the action of gravity, will move backwards and forwards for a considerable time, performing oscillations very nearly of the same duration.

In consequence of the retardation occasioned by the resistance of the air and friction, every vibration will be a little shorter than the preceding one; unless, when these are removed, (which we find it is possible in a great measure to do,) we perceive that the vibrations are continued for a longer period; and from this we are entitled to conclude, that if those causes of retardation could be entirely removed, the vibrations of the pendulum would continue for ever.

The simple pendulum to which all the experiments of the pendulum are referred, in whatever parts of the earth they are made, consists of a single weight attached to a string, supposed to be devoid of gravity, and performing its vibrations freely, without resistance, either from friction or the air. By means of this supposition, philosophers were enabled to overcome the difficulty which presented itself, arising from the size and figure of the suspended body, and the length and weight of the rod by which it was suspended, being necessarily included in all calculations and investigations on this subject.

The first proof of a positive and incontrovertible nature, of the diminution of gravity at the equator, was afforded by means of the pendulum. M. Richer being sent, in 1672, by the Academy of Sciences, to Cayenne, for the purpose of making astronomical observations, found that his clocks, regulated to mean time at Paris, lost a perceptible quantity every day.

The Island of Cayenne is only about 5° from the equator; the discovery, therefore, that a clock regulated at Paris by the mean motion of the sun, after being transported thither, lost every day 2 minutes, 28 seconds, was an important one.

By this experiment it was clearly established, that the force of gravity at Cayenne was less than at Paris; for when the pendulum deviates from its vertical position, the attracting force is gravity. When the power of gravity is increased, the time taken to return to its former situation by the pendulum is less; and when, on the other hand, the power diminishes, the time is increased.

This experiment exactly coincided with the reasoning of mathematicians concerning the earth, as depressed towards the poles. The pendulum affords the best means of determining this, as well as the theory of the diminution of gravity towards the equator.

One great advantage that has been brought forward, as possessed by the pendulum in measuring the force of gravity, is, that its vibrations are little affected by the direction of that force; whereas, the measures of degrees are extremely sensible to whatever affects the direction of gravity. It is perfectly unreasonable to imagine, however, that the pendulum, brought as it has been to so great a state of sensibility as to be able to measure this force with such precision, can be uninfluenced by the irregularities that may exist under the surface of the earth.

The various experiments of Captain Kater are extremely interesting, and have tended to throw light on this instrument; the nature of which had, for so great a length of time, perplexed philosophers of every country.

In every thing he asserts, we are able to coincide, from the experiments by which he establishes every thing he brings forward; which is what cannot be said of all who preceded him, in many of whose disquisitions on this subject much is stated that would certainly be incapable of verification by experiment.

Z. Z. Z.

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METHOD OF STUDYING MATHEMATICS.

GENTLEMEN,—In No. LXXVII. of your Magazine, a Correspondent, J. B. H., wishes to be informed what are the best treatises on four very important subjects. Two of them (mathematics and geography) I have made my particular study, and have also had long experience in communicating a knowledge of them to others. It may, therefore, deemed presumption in me pe that I may be able to your Correspondent and his , as to the course they ought sue, and the books they ought ct, in their laudable endea- o attain a knowledge of these seful sciences. Were I ac- ed with the circumstances of nquirers, I should be better suit my remarks to them. time and finances may not them to follow up the direc- would give them, in order in a knowledge of these s in the most eligible man- But, taking it for granted ey are so, I shall lay down an I think they should in se adopt. In mathematics, ght first to make themselves ghly acquainted with arith- a branch, the practical part ch is commonly attended to ry one, while the theory is amentably neglected. The hich developes, in the clear- most elegant manner, the les of this department, is sor Leslie's "Philosophy of etic." This work, how- may be considered too high for the generality of mechan- urchase. But there is an- most excellent work on the , by Professor Thomson, of elfast Institution, entitled, Treatise on Arithmetic in and Practice." To this can give my most unquali- probation. While it contains is most useful in practice, at arranged in a more logical r than is commonly adopted, contains a plain elucidation principles upon which the s operations are founded.— t, considering its great merits, e of the cheapest works on bject, and deserves a circula- finitely greater than it has o obtained. When the student has made himself master of arithmetic, he should next proceed to the study of the elements of algebra, and geometry. For the sake of variety, he might task himself in each of these studies alternately. The one may often be made to throw light on the other, but it would be difficult to say which should be studied first, in order to insure the most rapid advancement in the science as a whole. On algebra there are a number of works nearly on a level with each other as to merit. Either Bridge's, Bonycastle's, Emerson's, Wood's, Saunderson's, Simpson's, Euler's, or Dodson's, will suit a beginner in the study of algebra. But I would particularly recommend the three first to those who do not expect to have much assistance from a teacher. As to geometry, Simson's and Playfair's Elements seem to be in general use in the Universities of Britain. Of these two I give the preference to Playfair's; but I am doubtful if many will join me in considering Professor Leslie's Geometry superior to either. His arrangement I could prove better fitted for instruction than that adopted by any other geometrician, and the demonstrations of his propositions are commonly more elegant. While, however, I give my decided preference to the work of this gentleman, notwithstanding much has been written to blast its fame, and injure the author, by envious persons, and those generally ignorant of the subject, I am of opinion that either Playfair's, Keith's, Ingram's, Stone's, Bonycastle's, or Legendre's, will answer perfectly well the purpose of the student. The last, it is but fair to observe, contains a considerable quantity of original and very ingenious matter, a particular in which it scarcely yields to Professor Leslie's.

After the student has gone

through the first six books of geometry, he may next proceed to the theory of plane trigonometry, which is usually appended to the different works on the elements of geometry. Hitherto I have supposed his attention to have been chiefly confined to the principles of algebra, geometry, and trigonometry. When he has acquired a thorough knowledge of these, he might then proceed to the application of them to practice. But perhaps it would be better, and I believe every intelligent instructor of the science prefers, to have as much of the practice as possible deduced from the theory as occasions for doing so present themselves; for, by following up such a mode, the learner becomes early convinced that the speculative parts are by no means so unconnected with what is useful in life, as he is too prone to believe. But I forget that your enquirer is not to have the assistance of a teacher, at least his query would lead one to think so, for I cannot suppose he has in view the attendance of some particular class, and wishes to know, through the medium of your Magazine, what books he should use there. We all know that there are certain publications which every teacher chooses as text books, and these he considers the best. As your querist, then, is to be self-taught, he must defer the study of practical mathematics until he has made himself master of the theory. When the first six books of the Elements of Geometry are understood, a good plan would be to attend to mensuration of surfaces, and, after taking the elements of trigonometry, its application to the mensuration of heights and distances might form the succeeding study. If, in his advancement to this stage of the science, he has been also attending to algebra, we may suppose him to have reached the higher equations; in which case a very interesting study will present itself, *viz.* the application of algebra to geometry. If J. B. H., or any of his friends, attain this enviable height by their own exertions, Scotland will have cause to congratulate herself upon the possession of a few prodigies of genius, in a science which the generality of people want so much patience as is requisite for acquiring a knowledge of it, while they have all that flippancy of tongue that is requisite for its defamation.

I have described what books are necessary for conducting the student through a first course of the science; and as I dread that I have already made this letter inadmissable from its length, I will not enter upon a description of the best books for conducting him through a second course of the subject. When he has gone so far as my directions point out, should your Magazine and myself be haply in life, which is devoutly to be wished, I shall with much pleasure give him instructions how to proceed farther. The course I have prescribed will, I am afraid, be reckoned too expensive, and may call for more time than the most of mechanics can well spare. In this case I would recommend them to study some good synopsis of the science, such as Ingram's, or Davidson's, which, although they are chiefly practical, contain in many instances the principles of the rules. But if economy is any object with J. B. H. and his friends, and if they reside in Glasgow, it is impossible for them to gain this object along with a knowledge of mathematics in a better way than by availing themselves of the able assistance held out in the Mechanics' and Andersonian Institutions. Although the gentlemen who conduct the departments alluded to in these places, cannot be expected to make complete mathematicians of those who enter under their tuition, in the short time that can be allotted to their courses, they may still greatly assist their students in laying a foundation, upon which they may afterwards with little help rear a solid and useful superstructure. I find it impossible to give any instructions in this sheet, with regard to the study of geography; but should this letter be deemed worthy of admission amongst the good company which frequents your Magazine, I shall hand you another on the more interesting science of geography.—I am, yours, &c.

φ. β.

Glasgow, 20th June, 1825.

GLASGOW OBSERVATORY.

In the end of March 1809, a number of gentlemen met to deliberate upon the subject of an Astronomical Observatory for this City, which had been suggested by one of them; and, after conversations held at different times on the subject, it was agreed to obtain subscriptions, with the view of erecting a proper building, and procuring the necessary instruments, so as to form a great public seminary, and an ornament to the city. In consequence of the readiness with which many came forward to patronise the undertaking, and having the prospect of realizing their wishes, the friends of the Institution held their first meeting in the close of March; a short time after the subscriptions were opened, when the subscribers agreed to form themselves into an association, under the title of "The Astronomical Society of Glasgow."

They nominated Dr. Ure, (by whose exertions a considerable part of the subscriptions were obtained,) Observer and Superintendent. And, in order to carry into effect, in the most complete and perfect manner, the design they had formed, they sent him on a scientific mission to London, with instructions to submit the plans of the Society to the most distinguished astronomers in England, and to solicit their advice and instructions in the design and arrangement of the building, in the choice of instruments, and to secure a permanent interchange of kind offices; "so that, by engrafting as a branch on the mighty tree of science, the Glasgow Observatory, it might be expected to flourish in perennial vigour and fertility."

He carried with him introductions to Dr. Maskelyne, Astronomer Royal; Dr. Herschell; Mr. Pond; Lord Webb Seymour; Dr. Wollaston; Dr. Young; Mr. Groombridge; and Mr. Troughton.

After having several conferences with these and many other scientific gentlemen on the subject of his mission, and occupying himself for three weeks, with much ardour and diligence, in visiting every place where he expected information, he was at length introduced to Mr. Webster, a philosophical architect, who planned the Royal Institution; an artist who unites scientific attainments with classical taste and elegance of execution. After several conferences with Mr. Webster, the latter drew a plan of an Observatory, which, after receiving numerous alterations, was subjected to the inspection and criticism of Dr. Maskelyne, Professor Playfair, Dr. Wollaston, Lord Webb Seymour, Dr. Herschell, Dr. Wilson, Mr. Groombridge, Mr. Pond, and Mr. Troughton, who were all pleased to express their perfect satisfaction with it. He was also recommended to provide the Observatory with the following instruments:—A mural circle, by Troughton; an astronomical clock, on Hardie's improved construction; a chronometer, for determining the duration of an occultation, transit, or eclipse; an equatorial; and a grand reflecting telescope, by Herschell, 14 inches diameter in the aperture, and 14 feet long. Likewise, a repeating astronomical theodolite; a sextant; a reflecting circle; with several meteorological and other instruments for popular observation.

After Dr. Ure had communicated the result of his mission to the President of the Institution, a meeting of the Committee was called, and the whole was submitted to their consideration. The meeting declared themselves highly satisfied with the communication, and resolved, after having obtained General Brisbane's opinion (a gentleman who has a private observatory of his own, and who is at present Governor of New South Wales, where he continues to prosecute the study of astronomy,) on the selection of the instruments, to authorise Dr. Ure to commission those which would require a considerable period to execute, and to purchase others which could be advantageously procured on the spot. General Brisbane having politely favoured the Committee with an immediate reply to their queries, in which he assured them their Observatory, so provided, would be truly magnificent, the President immediately transmitted to Dr. Ure the result of the Committee's deliberations, whereby he was vested with full powers to treat for the instruments enumerated in his list.

In the course of the Doctor's researches in London, he was fortunate enough to meet with and procured a ten feet Herschelian telescope in high order, and a few other instruments, by which he saved the Institution more than a *hundred guineas.*

The whole of these proceedings mark the wisdom of the Committee, as well as the ability and zeal of their missionary, Dr. Ure.

A proper site for the Observatory having been previously agreed on, which is perhaps the best that could have been chosen, the highest part of the ridge of Garnet Hill, and which commands a delightful prospect, is free from smoke, is easily accessible, and not more than a few minutes' walk from the centre of the city, the ground was purchased for the building.

This temple of science was erected according to the plan of Mr. Webster, and all the instruments, except the mural circle, were procured.

The Institution, for a few years, appeared to flourish; but, a long protracted war, being succeeded by a state of great commercial embarrassment, the funds of the Institution became unequal to its expenses, and the Treasurer, after having advanced money until his patience was exhausted, in order to secure himself, in the year 1823, exposed the whole property to public sale. The building and instruments were purchased by a few public spirited individuals, for the specific purpose of preserving them for their fellow-citizens, in order that the Observatory might be re-established the first suitable opportunity. Mr. Longstaff, lecturer on astronomy, &c. having now undertaken its superintendence, arrangements are already making for the reception of annual subscribers, and in the mean time, the public are to be admitted to the use of the instruments on liberal terms.

With respect to the use and importance of astronomy, little, we should suppose, need be said. It is of the utmost importance to every commercial nation; is the parent of our naval, and, consequently, of our commercial greatness; and has been the primary agent in raising us to the commanding rank we hold among the nations of the world. True, much merit is due to the discoverer of magnetic polarity, and to the inventor of the chronometer, but the magnetic needle is subject to great variations, in different parts of the world, and is greatly affected even by local circumstances. The chronometer is also subject to great derangements from accidental causes. But the heavens are the same, yesterday, to-day, and for ever. By the knowledge of astronomy, we can foretell the place of a star, of a planet, or the commencement of an eclipse, not only within an hour or a minute, but even within a few seconds.

Many are the advantages of an Observatory to the citizens of Glasgow. In the first place, it will enable them to adjust the public clocks of the city; in the second place, it will enable the mariner to become acquainted with the requisite manipulations and details of nautical astronomy; in the third place, it will enable young persons of both sexes, who are studying astronomy, to acquire a more complete acquaintance with that science than can possibly be obtained without the use of instruments; for, notwithstanding the advantages of orreries, planetariums, and tellurians, in unfolding to the young mind a knowledge of the construction of the universe, yet the actual observation of the heavens is the easiest, the noblest, and the most improving method of acquiring a knowledge of their structure and revolutions; and in the last place, besides supplying a noble recreation to our active citizens, during the interval of business, it will also enable gentlemen, at a small annual expense, to enjoy, in the greatest perfection, the use of the finest telescopes which art can fabricate, and which cannot be advantageously procured for viewing either the heavens or the surrounding country by any private individual, but at an immense expense. This ought to be regarded as a luxury of the most refined and elegant description, and will certainly tend to diffuse an additional light over the public mind, and to give occasionally a pleasing and elevated turn to the conversation of the social circle.

Finally, it is a knowledge of the science of astronomy which has enabled man, frail and feeble as he is, to brave the mighty power of the tempest, even on the fluctuating bosom of the deep. Guided by his knowledge of the heavens, he fears not to quit the sight of his native shores, and wander amid the trackless ocean, in quest of unknown lands; by the aid of astronomy, he compasses the wide world, blesses his own country with the riches of every climate which is visited by the light of heaven, and opens an intercourse with all the inhabitants of the earth, for the universal distribution of knowledge, and for the civilization and improvement of the habitable globe.

In a short time we will resume this subject, and enter more into the minutiæ of the plan which the present spirited proprietors intend adopting. We are enabled to state, however, that the whole will be conducted on the best footing, and the management of it strictly popular.

QUERIES.

1. How to cut the thread of common screw-nails, as practised in the manufactories in England? I frequently require to cut screws from $\frac{3}{8}$ to $\frac{3}{4}$ of an inch *thick*.

2. How to remove the crust off the inside of tea kettles either of copper or iron?

A CONSTANT READER.

Rose-Street, Edinburgh.

LIST of several of the most eminent PAINTERS of the OLD SCHOOL, with a Scale of their different merits, so far as regards Composition, Design, Colouring, and Expression.

School.	Name. Date of Birth and Death.	Composition.	Design.	Colouring.	Expression.
Lombard,	Albano, born 1578, died 1660,	14	14	10	6
Flemish,	Albert Durer, born 1470, died 1528,	8	10	10	8
Roman and Florentine,	Andrea del Sarte, born 1478, died 1530,	12	16	9	8
Roman,	Baroche, born 1528, died 1612,	14	15	6	10
Venetian,	James Bassau, born 1553, died 1613,	6	8	17	0
Venetian,	John Bellin, born 1421, died 1501,	4	6	14	0
French,	Bourdon, born 1513, died 1588,	10	8	8	4
French,	Le Brun, born 1620, died 1690,	16	16	8	16
French,	Claude Lorraine, born 1600, died 1682,	18	18	16	0
Lombard,	Annibal Carracci, born 1557, died 1606,	15	17	13	13
Lombard,	Correggio, born 1494, died 1534,	13	13	17	12
Roman,	Daniel de Volterra, born 1509, died 1556,	12	15	5	8
Flemish,	Diepembeck, born 1608,	11	10	14	6
Lombard,	Dominechino, born 1581, died 1641,	15	17	9	17
Venetian,	Georgioni, born 1477, died 1511,	8	9	18	4
Lombard,	Guido, born 1575, died 1642,	0	18	9	12
Flemish,	Holbein, born 1498, died 1544,	9	10	16	3
Flemish,	James Jordans, born 1594, died 1678,	10	8	16	6
Flemish,	Lucio Jordano, born 1632, died 1705,	13	12	9	6
Roman,	Julio Romano, born 1446, died 1500,	15	16	4	14
Lombard,	Lanfranc, born 1581, died 1647,	14	13	10	5
Roman,	Leonardo da Vinci, born 1445, died 1520,	15	16	4	14
Flemish,	Lucas de Leide, born 1495, died 1535,	8	6	6	4
Roman,	Michael Angelo Buonarotti, born 1474, died 1564,	8	18	4	8
Lombard,	Michael Angelo Caravaggio,	6	8	16	0
Venetian,	Muticus, born 1528, died 1590,	6	8	15	4
Flemish,	Otho Venius, born 1556, died 1634,	13	14	10	10
Venetian,	Palma, the elder, born 1460, died 1556,	5	6	16	0
Venetian,	Palma, the younger, born 1544, died 1628,	12	9	14	6
Roman,	Parmesan,	10	15	6	6
Venetian,	Paul Veronese, born 1532, died 1588,	15	10	16	3
Roman,	Perin del Vague, born 1500, died 1547,	15	16	7	6
Roman,	Pietro de Cortona, born 1596, died 1669,	16	14	12	6
Roman,	Pietro Perugino, born 1524, died 1602,	4	12	10	4
Roman,	Polidore de Caravaggio, born 1596, died 1643,	10	17	0	15
Venetian,	Pordenon,	8	14	17	5
French,	Nicholas Poussin, born 1594, died 1665,	15	17	6	15
Roman,	Primatrice, died 1570,	15	14	7	10
Roman,	Raphael, born 1483, died 1520,	17	18	12	18
Flemish,	Rembrandt, born 1606, died 1668,	15	6	17	12
Flemish,	Rubens, born 1577, died 1640,	18	13	17	17
Roman,	Salviati, born 1510, died 1563,	13	15	8	8
French,	Le Sueur, born 1617, died 1655,	15	15	4	15
Flemish,	Teniers, born 1582, died 1649,	15	12	13	6
Roman,	Pietro Testo, born 1611, died 1650,	11	15	0	6
Venetian,	Tintoretto, born 1512, died 1594,	15	14	16	4
Venetian,	Titian, born 1477, died 1576,	12	15	18	6
Flemish,	Vandyck, born 1599, died 1641,	15	10	17	13
Roman,	Vanius, born 1556, died 1634,	13	15	12	13
Roman,	Tadee Zucree, born 1529, died 1556,	13	14	10	9

M. DUPIN'S ADDRESS TO THE MECHANICS OF PARIS,

Delivered in November last, at the Conservatoire Royal Des Arts et Metiers.

[Continued from page 351.]

In order to construct these pumps, and these steam-engines, we require engineers, and very able workmen, who exercise invention, and possess practical dexterity; men who know how to plan the different parts of a complicated whole, in order that they may act together, with the advantage produced by exactness. All these workmen, I repeat, will be put in activity, to replace the unartificial butt of the water-carrier, and the fatigues of this labourer.

You see, gentlemen, in the change produced by the science of mechanics, how the animal occupations of man are transformed into others more intelligent, more easy, and more worthy of the human species. You must acknowledge with me, that science, which procures these benefits for society, is essentially the friend of the working classes, and that it nobly raises the occupations of the artist, by seconding the physical efforts by all the faculties of the mind which science brings to perfection.

The only thing which can afflict the friend of humanity, is the difficulty of producing a great amelioration similar to that of which I have just given you an idea, by mechanics, without a great number of men being obliged, for a certain time, to abandon their former occupation in order to seek a new one. It is then that these poor workmen should be generously assisted; these innocent victims of a change which is useful to all the rest of society.

Here, gentlemen, genius can make a great and noble employment of its inventive resources, in order to discover new means of employing those classes which are thrown out of work; in order to render the individuals of these classes again useful to themselves, as well as to society, in opening a new course for industry.

Let me be permitted to mention to you a benefit of this kind, which is due to my former master, and my friend, M. de Prony. The name of an engineer so celebrated, must be repeated more than once in a course of mechanics applied to the arts.

Thirty years ago, M. de Prony was commissioned by government to compose an extensive table of logarithms, in order to raise a monument to the science of numbers, more magnificent than any which had been before erected. It was easy to give such an order, but how was it to be executed? How were such a number of learned men and able calculators to be brought together, as would be sufficient for all the operations of this immense enterprise?

At this time, gentlemen, a great change was introduced in the head-dress of men and women. It was reduced, to use the mathematical term, to its *most simple expression*. One hair-dresser was then sufficient for a labour which had employed ten before, and a vast number of *perruquiers* found themselves, at once, without the means of existence.

M. de Prony conceived the idea of transforming these *perruquiers* into calculators, and of making them assist in the execution of his great tables.

He divided and subdivided his labour; he prepared learned forms, which could be filled up by persons who knew only addition; he set his hair-dressers to work; he gave them the means of existence; and by their means fulfilled his purpose, which was to construct the finest tables of logarithms in the universe.

Honour be awarded to science, when it concurs with the progress of the human mind; whilst it stretches out to the unfortunate a succouring and a generous hand.

Let us return to the class thrown out of employment by some great revolution of fashion or of industry. It must employ its activity, its care, its energy, in creating for itself new occupations. Soon, without doubt, the desire so natural and so laudable, of subsisting by its own means, of living by its own labour, and of ameliorating its own existence, will excite the artizans of this class to seek for the means of employing their powers and their understanding, in the pursuit of occupations less troublesome and less mechanical. At last, they will even bless the change which removes them from difficult and debasing trades, to give them professions which recal them to the exercise of thought.

This multitude of robust men, at first

deprived of employment, and soon passing into other channels of industry, augment their power of production, and thus the perfecting of a single art contributes, by a species of re-action, to the advancement of a number of other arts.

You see, gentlemen, that, in reality, the progress of machinery, of that even which appears directly to interfere with the employment of human power, so far from being considered an enemy of the working class, and as taking away the bread of poor families, has for its result, on the contrary, to render their life more comfortable, and to procure more ease to the labouring classes.

These truths, which I am not afraid confidently to advance before you, have received from experience a confirmation which does not admit of the smallest doubt.

When the stocking machine was first introduced, it all at once deprived of their employment many persons who obtained their support from knitting. These persons made very loud complaints, and proceeding from complaints to actions, began to destroy the machines which took away their labour. But broken machines, by ruining the masters of the manufactories, could not give to these masters additional means for supporting the workmen; and misery prevailed on both sides. Order was at last established; the machines prospered; and the persons who gained a few pence daily by knitting from morning till night, driven from this miserable occupation, found in the progress of industry occupations much more lucrative. Formerly, Normandy was full of people, who passed their time in knitting; and they who made the stockings did not gain even enough to enable them to wear them. Now that there are machines, not a person is to be found who travels stockingless in Normandy.

I may offer you a great example, an irresistible proof, which I derive from the country wherein the substitution of machines for manual labour has made the greatest and most rapid progress.

You have, without doubt, heard, that England is, of all civilized countries, that which has the greatest number of poor, and that this poverty is owing to the want of employment caused by machines. The most learned, and the most able men have partaken of this error, in spite of the luminous refutations which have been given by some *good observers.*

I have exerted myself for some years to show, both by reasoning and by calculation, how far these opinions are removed from the truth; but the most convincing demonstrations, when they are contrary to generally-received opinions, and long-rooted prepossessions, glance over the mind and are rejected by prejudice. The only argument which it is possible to receive in this case, is that of facts. Happily for us, on the subject of the poor and machines, I can offer you proofs of this species; and I flatter myself that they will carry to your minds a full and entire conviction. The English Parliament has caused to be laid before them the number of poor, and the total sum which is given under the title of public charity, by means of the tax called the poor's rates. These reports have been made in time of war, and in time of peace. Afterwards, it has been calculated for each county; on one side, the total number of poor, and on the other, the total sum which is given to them.

The results of this investigation Parliament has caused to be printed.

In examining these results with attention, I have remarked with great surprise, that the counties the most burthened by the poor's rates are principally employed in agriculture; whilst the least burthened are principally devoted to manufactures; and are those in which are to be found the most of those great machines, which appear to render useless a crowd of workmen.

During the war in 1811, nine of the counties most engaged in agriculture, paid for the poor a tax equivalent to *twenty-nine francs* (twenty-four shillings) a head; supposing this sum to be levied upon all the inhabitants of the nine counties.

At the same time, nine counties most devoted to manufactures, paid for the poor a tax equal only to *twelve francs* (ten shillings.)

During the peace in 1821, the nine agricultural counties paid *twenty-one francs* (seventeen and sixpence) a head for the poor; and the nine manufacturing counties only paid *ten francs* (nine shillings.)

These facts speak loudly, gentlemen; they demonstrate to you the great utility of machines to the workmen, and to the poor themselves: they show still better, that for a long time, the workmen and the poor of the manufacturing counties have not gone to gain a livelihood in the agricultural counties; but, on the contrary, that it is the labourers who go from the country to the towns, in order to seek the means of subsistence which agriculture is not sufficient to procure for them.

It is necessary, I allow, to give you these proofs, and to advance them to myself. I should blush to profess a science, the progress of which would injure the least fortunate part of society: and I would cease from extending those discoveries, which do the greatest honour to the genius of their authors, if such discoveries were not favourable to the happiness of the human species.

On the contrary, I feel myself animated by a new influence when these truths offer themselves to me, as sure and powerful means of adding to the comfort and dignity of men of every rank.

It is not sufficient for me to have shown to you, that in England, the whole number of the working class, although it has increased prodigiously since the commencement of the present century, has had less and less occasion to be assisted by the opulent part of the country. You must also be shown in what consist the changes which have taken place in the condition and the morals of men who are engaged in mechanical operations. I hope by this, to stimulate those amongst our citizens who live by labour; to awaken a generous emulation, and a desire not to remain behind our rivals in a career of improvements. The facts that I shall lay before you, will offer besides to the heads of great establishments, who honour this first lecture with their presence, examples worthy of being put in practice in their work-shops and their manufactories.

Formerly, in Great Britain the working classes, as well as the superior classes of society, were addicted to excessive drinking. This vice infested and degraded all ranks, from the general to the private soldier, and from the nobleman to the artizan.

At present this vice is much diminished, not merely in the more elevated ranks; it has disappeared almost entirely from those professions in which the artizan has felt the necessity of being instructed.

Such is the amelioration, which is evident, especially amongst the workmen employed in making machines: workmen who generally can read, write, and cypher: and who, for the greater part, are acquainted with the first elements of geometry, as well as many of the principles of mechanics.

[To be continued.]

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MISCELLANIES.

Newspapers.—We are indebted to the Italians for the idea of newspapers. The title of their *gazettas* was most probably derived from a small coin peculiar to the city of Venice, called gazetta, which was the common price of their newspapers. It has also been said to be derived from the Latin *gaza*, which would colloquially lengthen into *gazetta*, and signify a little treasury of news. Newspapers then took their birth in that principal land of modern politicians, Italy, and under the government of that aristocratical republic, Venice. The first paper was a Venetian one, and that only monthly; but it was the newspaper of the government only. Other governments afterwards adopted the Venetian plan of a newspaper, with the Venetian name for it; and from one solitary government gazette we see what an inundation of newspapers has burst upon us in this country.

Mr. Chalmers, in his Life of Ruddiman, gives a curious particular of these Venetian gazettes. "A jealous government did not allow a printed newspaper; and the Venetian gazetta continued long after the invention of printing, to the close of the sixteenth century, and even to our own days, to be distributed in *manuscript*." In the Magliabechian library at Florence are thirty volumes of Venetian gazettas, all in manuscript. Mr. Chalmers discovers in England the first newspaper. "It may gratify national pride (says he) to be told that mankind are indebted to the wisdom of Elizabeth, and the prudence of Burleigh, for the first newspaper. The epoch of the Spanish armada is also the epoch of a genuine newspaper. In the British Museum are several newspapers, which had been printed while the Spanish fleet was in the English Channel, during the year 1588. It was a wise policy to prevent, during a period of general anxiety, the danger of false reports, by publishing real information. The earliest newspaper is entitled "The English Mercurie," which, by *authority*, was "imprinted at London by her highness's printer, 1588." These, however, were only extraordinary gazettes, and not regularly published; and it appears that even in this obscure origin they were skilfully directed by the policy of that great statesman, Burleigh, who, to inflame the national feeling, gives an extract of a letter from Madrid, which speaks of putting Elizabeth to death, and describes the instruments of torture on board the Spanish fleet. The first newspaper in the collection at the British Museum is marked No. 50, and is in Roman, not in black letter. It contains the usual articles of news, like the London Gazette of the present day. In that curious paper there is intelligence, dated from Whitehall, on the 23d of July, 1588. Under the date of July 26, there is the following notice:—"Yesterday the Scots' ambassador being introduced by Sir Francis Walsingham, had a private audience of her majesty, to whom he delivered a letter from the king his master, containing the most cordial assurances of his resolution to adhere to her majesty's interests, and to those of the protestant religion." And it may not here be improper to take notice of a wise and spirited saying of this young prince (he was then twenty-two) to the queen's minister at his court, "That all the favour he expected from the Spaniards was, the courtesy of Polypheme to Ulysses, *to be the last devoured*." The aptness of King James' classical saying, carried it from a newspaper to a history.

In the reign of Queen Anne there was but one daily paper; the others were weekly. Some attempted to introduce literary subjects, and other topics of more general speculation. Sir Richard Steele then formed the plan of his *Tatler*. He designed it to embrace the three provinces of manners, of letters, and of politics. The public were to be conducted insensibly into so different a track from that to which they had been hitherto accustomed. Hence politics were admitted into his paper. But it remained for the more chaste genius of Addison to banish this disagreeable topic from his elegant pages. The writer of polite letters felt himself degraded by sinking into the dull narrator of political events. From this time newspapers and periodical literature became distinct works.

Languages.—From the work of the learned Adelung, we find that there exists no less than 3064 different languages used in various parts of the earth.—There are of these,

European, ...	587
Asiatic, ...	937
African,...............	276
American, ...	1,264

The May Pole.—The leisure days after seed-time had been chosen by our Saxon ancestors for folk-motes, or conventions of the people. Nor till after the Norman conquest, the Pagan festival of Whitsuntide fully melted into the Christian holiday of Pentecost. Its original name is Wittentide, the name of choosing the wits, or wise men, to the Wittenagemotte. It was consecrated to Hertha, the goddess of peace and fertility; and no quarrels might be maintained, no blood shed, during this truce of the goddess. Each village, in the absence of the baron at the assembly of the nation, enjoyed a kind of saturnalia. The vassals met upon the common green, round the *May Pole*, where they elected a village lord, or king, as he was called, who chose his queen. He wore an oaken wreath, and she a hawthorn wreath, and together they gave laws to the rustic sports during these sweet days of freedom. The *May Pole* then is the *English tree of liberty!* Are there many yet standing?

NOTICES TO CORRESPONDENTS.

We wish much our Correspondent φ. β. would favour us with a letter continuing his directions for the study of Mathematics. Although he probably has said as much as can in the mean time be useful to J. B. H., yet it is very clear it must be highly advantageous to many to have so important a subject as mathematical education treated with so much good sense and knowledge, as appears in our Correspondent's first letter. At any rate we expect to hear from him on the subject of Geography. We have to thank "A Mechanic" for his letter, in which there are many sensible remarks; but he will perceive he is superseded by the letter in our present Number, which was in types before we received his. G. M., Edinburgh, is informed, that we cannot notice what he states as to the invention of Steam Navigation, without having seen the book he mentions, a copy of which we do not possess.

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THE GLASGOW
MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

" It is by means of words only, that a man becomes excellently wise, or excellently foolish."

No. LXXXII. *Saturday*, 16*th July*, 1825. Price 3*d*.

DIXON VALLANCE'S MODE OF APPLYING THE LEVER TO THE WORKING OF MACHINERY.

Fig. 1.

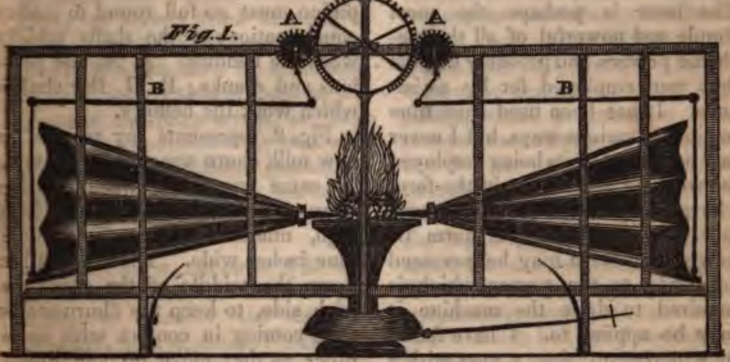


Fig. 2.

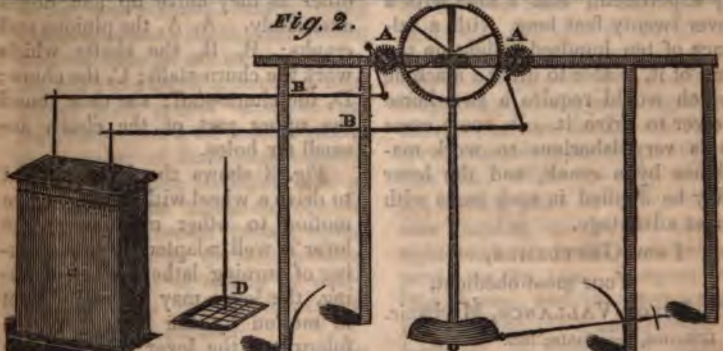
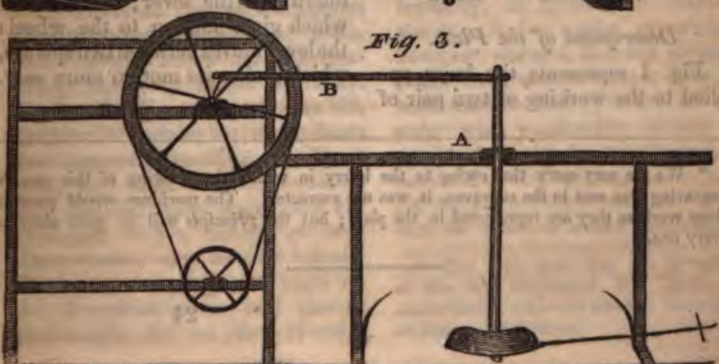


Fig. 3.



ON THE APPLICATION OF THE LEVER TO THE WORKING OF MACHINERY.—By Dixon Vallance. *

Gentlemen,—In a former communication, I gave you my new plan for impelling boats and barges, &c. I again take the liberty of laying before you my plans for working machinery by means of a lever. The lever is perhaps the most simple and powerful of all the mechanic powers, and probably was the first man employed for his assistance. It has been used from time to time in various ways, but I never saw nor heard of its being employed for working machinery in the form I have here presented it. The length and weight of the lever form its power, and these may be increased according to the power which is required to drive the machine it may be applied to. I have found by experiment, that a man with a lever twenty feet long, with a balance of ten hundred weight on the end of it, is able to drive a machine which would require a two-horse power to drive it. In some cases it is very laborious to work machines by a crank, and the lever may be applied in such cases with great advantage.

I am, Gentlemen,
Your most obedient,
Dixon Vallance, Mechanic.
Libberton, Lanarkshire, 1825.

Description of the Plate.

Fig. 1 represents the lever applied to the working of two pair of bellows adapted for founders and smiths, &c. Round the fulcrum of the lever is placed a wheel which works two pinions with cranks on their axis, and this again works the shaft or shafts of the bellows. The pinion must go full round to make equal motions to the shafts which work the bellows. A, A, the pinions and cranks; B, B, the shafts which work the bellows.

Fig. 2 represents my plan of a new milk churn wrought by a lever, the same way as the bellows; the churn is about four feet and a half high, nineteen inches long, and nine inches wide. There is a fillet down the middle of the churn on each side, to keep the churn-staffs from coming in contact with each other as they move up and down alternately. A, A, the pinions and cranks; B, B, the shafts which work the churn-staffs; C, the churn; D, the churn-staff; the dots round the upper part of the churn are small air holes.

Fig. 3 shows the lever applied to drive a wheel with a belt, to give motion to other machinery; the lever is well adapted to the working of turning lathes; when working, the lever may be easily kept in motion by the foot. A, the fulcrum of the lever; B, the shaft which gives motion to the wheel: the lever moves between two springs, which makes its motion more easy.

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* We are very sorry that owing to the hurry in which the drawing of this week's engraving was sent to the engraver, it was not corrected. The machines would none of them work as they are represented in the plate; but the *principle* will be quite clear to every one.

ACCOUNT OF THE FERRY ACROSS THE TAY AT DUNDEE.

By Captain Basil Hall, R. N., F. R. S. L. & E.

[The improvement of the public ferries throughout the country, particularly the Highlands, we conceive to be a subject of very great importance, and one requiring the attention of the public. In order to show the benefits which are likely to accrue from the use of steam vessels at the more important ferries, we have been induced to give some extracts from an account of the ferry across the Tay, at Dundee, published by that able officer and accomplished gentleman, Captain Hall, in the last No. of the Edinburgh Philosophical Journal.]

In 1817, the counties of Fife and Forfar appointed a Joint Committee to consider the state of the ferry, and to concert measures for its improvement: and it being apparent, upon a slight examination, that, in spite of all its drawbacks, the ferry produced a revenue adequate, with proper care, to the maintenance of a far better system, the number of boats was reduced from twenty-five to eight; and at the same time rendered efficient by stronger crews, better equipment, and, as far as was possible, by punctuality of sailing at stated periods. The landing-places were also greatly improved.

In 1819, an Act of Parliament was procured for erecting piers, and otherwise improving and regulating the ferry across the Tay. During the discussions on this bill, the idea of employing steam-boats first suggested itself to the Trustees; and after careful inquiries, they decided upon trying the experiment, with a double or twin steam-vessel, such as they learned had been in use for some years on the American rivers, and also at Hamburgh, and on the Mersey, near Liverpool.* It was not, however, till towards the end of the year 1821, that the steam-boat began to ply. Previous to that period, but after the improvements had been made in the sailing-boat establishment, the number of foot passengers was about 70,000 annually, and the receipts £2510. There was still, however, no convenient or certain means of transporting cattle or carriages across, except at certain times of the tide, and in fine weather. Until the twin-boat was established, and indeed even for some little time after she began to ply, no very great increase in the revenue took place. There was still a defect in the arrangements, owing to a circumstance which had not been foreseen in time to have it duly guarded against in the Act of Parliament, and which, in consequence of this inadvertency, cost the Trustees a long course of the most unpleasant altercation, and finally, the loss of a considerable sum of money. It was this: While the only convenient landing-place on the north side was Dundee, on the Fife coast or right bank of the Tay, there happened to be two, Newport and Woodhaven, and the steam-vessel was made to ply from Dundee alternately, to these two landing-places. A few weeks' experience, however, showed, that the greatest public inconvenience must ever attend this alternate system; for not only was punctuality (which it ought always to be recollected, is essential to the existence of a proper ferry) entirely broken in upon, but, in spite of every notification hat could be given, passengers were perpetually mistaking the proper point of call. Sometimes the tide, sometimes the wind, did not serve for Woodhaven, and it often happened, that, when circumstances obliged the boat to steer out of the direct course, the people, who were waiting her arrival, were inevitably misled, and so, by repairing to the wrong place, lost their passage altogether. The complaints of the excessive inconvenience of this plan, by every class of passengers, after a few months' trial, became so loud and general, that the Trustees, in July 1822, directed the boat in future to call at Newport only, on the Fife side. The effect was instantaneous; the public regained confidence, and the revenues of the ferry increased rapidly. The following is the amount of the fares collected for the last five years :—

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* The Twin-boat was the invention of the late celebrated Mr. Miller of Dalswinton, who was also the discoverer of Steam Navigation.

In 1820,..........	£2510	6	1
1821,..	2526	13	9
1822,............	3209	9	0
1823,............	3552	4	10
1824,............	3790	12	10

It will give a good idea of the importance of this ferry, to state the exact number of passengers, cattle, &c. which crossed in the year 1824.

Foot Passengers,............	100,536
Carriages,.....................	130
Gigs,..........................	474
Cattle,........................	6,627
Sheep,..................	15,449
Horses,........................	4,777
Loaded Carts,................	2,564

The distance from Dundee to Newport, in a straight line, is one statute mile and a little more than a half, or very nearly 2,760 yards. At certain times of tide, the passage cannot be made directly across, owing to the mud-banks which lie nearly in the middle of the stream; so that the average distance of the passage, allowance being made for the set of the tide, may be stated at about two miles and a third. This passage is made by the twin-boat in seventeen minutes, at an average, in neap tides; and in twenty-three at spring tides. In very blowing weather, it sometimes takes from thirty to fifty minutes, and once it took an hour. During 1824, the passage was never interrupted for one whole day; and it was only five times detained throughout the whole year, owing to hard westerly gales during the ebb tide.

There are two steam-boats belonging to the ferry, one of which is employed at a time, except in harvest, when the reapers come down, or at the seasons when numerous droves of cattle come from the north. On these occasions, both are put in requisition, though not absolutely necessary, in order to avoid the possibility of delay. In order still farther to meet the public convenience, a pinnace, with four able seamen is stationed at each side of the ferry, for the purpose of affording a passage to travellers who are unwilling to wait for the periodical sailing of the steam-boat. These boats are also in attendance during the night, when the steam-boat has ceased to ply.

As the twin-boat is very little known as yet in this country, an account of one may possibly prove interesting, if not useful to some readers. There are some material differences between the two boats at Dundee, but that last built being the most perfect of the two, a description of her will be the most satisfactory.

She is called the George the Fourth; is 90 feet long over all, and 29 broad; she has 6 feet 8 inches depth of hold; and draws, when light, 4½ feet of water—and, when loaded, rarely more than 5 feet 4 inches. She is of the double kind of steam-boat, with a single paddle-wheel, working in the middle, between two divisions, or separate smaller boats, placed parallel to one another, at the distance of 8 feet apart. Over these two divisions, are placed horizontal beams, covered by a deck, the planks of which, instead of being placed fore and aft, in the usual way, cross the vessel from side to side, and thereby contribute greatly to the strength of the whole. To a person standing on the deck, she appears to be but one vessel. At each end there is a space railed off for cattle, one 33 feet by 27½, the other 27½ by 21. From 80 to 90 head of cattle is her average load; but, upon one occasion in fine weather, she actually carried 103 cattle, and 3 horses. In the middle part of the deck, between the spaces allotted for cattle and carriages, there is ample space for foot passengers, for whom also, in rainy weather, there are two commodious cabins. The machinery of the two steam-engines (each of 20 horse power,) is concealed below; but the paddle wheel, being 14 feet in diameter, necessarily rises considerably above the deck, where it is covered by a wooden case. This wheel is 7 feet wide, and is immersed 18 inches in the water. It is a matter of perfect indifference which end of the boat goes foremost, both being alike in all respects. As the method of fixing the rudders, one of which is fixed at each end, is, of course, different from that of a ship, it may be useful to describe it particularly. The rudder is a plate of iron 4½ feet long, and 3 feet deep. It is fastened to a vertical spindle, reaching from the middle of the stern to the water. In the first boat employed in the Tay, the rudder was attached by one end to the spindle, so that, when she was in motion, its whole length trailed behind. But this rudder being found difficult to move, a device was adopted which answers the purpose perfectly. The spindle, instead of joining the rudder at the end, is fixed to it at one-third of the length; so that, when the vessel is in motion, two thirds are abaft, and one-third before the spindle, resembling a large weather-cock, or vane inverted. A horizontal wheel is fixed to the upper extremity of the spindle, and this is turned by a wheel and pinion by the steersman. Both the divisions composing each twin-boat are flat bottomed, have perpendicular sides, and are sharp bowed; the angle at which the two bows meet at the extremities being 60°, ample room is allowed for the escape of the back-water. The rudder is placed in the middle point between the two stems; and, of course, lies directly in the centre of the current of back-water thrown out by the paddle-wheel. The steersman stands on a raised platform, above the taffrail, from whence he commands a clear view over the paddle-case. There are no masts; and the only resistance which is offered to the wind, is from the chimneys of the engines.

Though the manner in which the two engines of a steam-boat are made to act in concert, be known to every person at all acquainted with the subject, it may perhaps interest some readers to describe, in a popular way, the beautiful device by which this object is accomplished. The paddle-wheel is moved by one continuous shaft, to which both engines give their impulse, by means of two cranks, or bends in it, formed so as to be at right angles to each other. Thus, when one of the cranks is either quite up, or quite down, and consequently, the power of the engine connected with it, for the moment, entirely gone, the other crank must be in a horizontal position, and the power of its engine will be, for the same moment, at a maximum. The result therefore is, that, precisely in proportion as one engine loses power, the other gains it; and, consequently, the united effect of the two, against the resistance, at every instant of their action, is virtually equal to the constant power of one of them at its greatest; so that, whether the engine be moving fast or slow, or the resistance great or small, the same uniform force is exerted.

At each of the landing-places, there have been built low-water piers; along the sides, or across the ends of which, the steam-boat can be placed at any time of the tide, and during all weathers; so that passengers and cattle are embarked with as much ease as if they were going along a bridge; while carriages and carts drive in on one side of the river and out again on the other, without removing the horses. The utmost attention is paid to the hours of departure. Three minutes before the town clock of Dundee strikes the hour, a bell is rung on board the boat; and the instant the hour is told, the paddle-wheel begins to move, and the vessel to glide from the pier. In like manner, when the half hour strikes at Newport, she quits the opposite pier; and so on from sunrise to sun-set; her crossings and recrossings never being interrupted.

To insure the constancy of this essential, but very difficult point, an able and active superintendent has been appointed, with a handsome salary, and a house on the spot:—his exclusive business is to arrange the whole details of the passage, and to prevent all unnecessary delays. A collector also is appointed, a *gentleman who*, in like manner, resides constantly on the spot, and attends exclusively to the money department. In consequence of the vigilance of these two officers, acting under the judicious regulations which the trustees have from time to time established, it is most worthy of remark, that, however great the crowd of cattle, carriages, or passengers may be, not the least delay or confusion ever arises, either at the embarkation or relanding.

On board the boat the system is equally perfect: there is a cockswain, an engineer, five seamen, and a fireman. Long practice has given to those people so exact a knowledge of the power which is in their hands, that this huge and apparently unweildy boat, is moved about with a celerity and precision altogether astonishing. To a stranger, however much accustomed he may have been to the wonders of machinery elsewhere, the effect is truly magical. The steam-boat, or, more properly, this great double raft, is discovered advancing at the rate of seven or eight miles an hour, directly for the shore, threading her way like a little skiff amongst the vessels lying in her way. In a few seconds she arrives, still at full speed, close to the shore. In the next instant she is arrested, by a touch of the engineer's hand, as suddenly as if she had struck upon a rock; and is placed, by the sole instrumentality of her invisible machinery, close by the side of the pier, with as much accuracy as if she were in a dock, and as much gentleness as if, instead of being made out of stout oak and iron, she were formed of glass. In a moment, two great folding gangways are lowered down, and her side being thus thrown open, cattle, horses, passengers, all walk out, and find themselves on land, with scarcely any circumstance having occurred to indicate they had been on the water.

ON THE LAWS OF PLANETARY MOTION DISCOVERED BY KEPLER.

Of the physical sciences cultivated by philosophers among the ancients, astronomy is that in which most considerable advances were made. This was to be expected from the circumstances attending these investigations; the objects on which they were employed in them being constantly before them; and in their nature and appearance so remarkable, as in all climes to fix irresistibly the attention of mankind, but more especially in those, the serene temperature of which invited attention to those interesting objects. Consequently, in Egypt and Chaldea we find the first notices of any attention having been paid to the heavenly bodies. And here the first object which seems to have struck them was the observation of eclipses: indeed their practical astronomy seems to have been confined chiefly to these, to the principal stars, and their occultations by the moon and planets.

Although a history of the progress of this science in different countries would be extremely interesting, it would be foreign to our present subject, and besides would extend far beyond the limits of a short sketch of this kind. Suffice it to remark, that astronomy, after escaping from the narrow and circumscribed limits by which it had been bounded by ignorance and prejudice, rapidly raised itself to the situation it now occupies, in which all the mathematical sciences concur to maintain and support it.

If the motion of the planets round the sun was performed in circular and uniform orbits, the calculation of their position at any given time could be made with ease and precision. But, owing to the inequalities in these, difficulties of rather a formidable nature would have presented themselves, had not Kepler discovered some general facts with regard to them, by which, fortunately for science, their real motions were at last ascertained.

His observations were first directed to the planet Mars, the orbit of which being one of the most eccentric of the planetary system, greatly aided his investigations by the perceptible inequalities in its motion. He endeavoured for a considerable time to adapt the motions of Mars, to what had always before his time been received as the true hypothesis, *viz.* motions circular and uniform. He fortunately soon after conceived the idea of comparing its motion with that of the ellipse, placing the sun in one of the foci, and such, that the radius vecter drawn from its centre to that of the sun, describes equal areas in equal times.

As Kepler was aware that the duration of the planetary revolutions increases with their mean distances from the sun, he suspected some relation or proportion must exist, in which these stood to each other. After seventeen years of meditation on this subject, he ascertained that the squares of the times of the planetary revolutions are to each other as the cubes of the greater axes of their orbits.

The discovery of these laws of planetary motion doubtless led to many very important results; and to none more so than the discovery of universal gravitation. These we shall notice in the following remarks on them in their order:—

His first discovery corrected the erroneous notion which had been formerly entertained of these bodies, and ascertained that each planet describes an ellipse, having the sun in one focus.

When a deflection arises in different points of the ellipse, the proportion between any two of them may be ascertained, provided we are able to observe exactly the proportion of the arches, described in equal small moments of time. The same thing applies to the forces which retain satellites in their elliptical orbits round the planets; for since we are certain from observation and experience that they describe ellipsis, having their primary planet in the focus, the same remark must hold with regard to them. The ellipse is described by fixing the extremities of a thread upon two immoveable points, which being stretched upon a plane, traces a curve which is elongated in the right line which joins the foci, and which being extended on each side till it meets the curve, forms what is called the greater axis, and divides the ellipse into two equal and similar parts. Kepler's observations on this fact coinciding so exactly with those previously made by Tycho Brache, to whom he had been an assistant in many of his observations, confirmed him as to its truth, and induced him to persevere in those researches which have led to results so beneficial to the study of Natural Philosophy. He was greatly assisted by the previous observations of Tycho, from which, indeed, he principally calculated the distance of Mars from the sun in different parts of the orbit, and proved that it could not possibly be adjusted to the circumference of a circle. This was completely established when Newton showed afterwards, that by the theory of attraction, which proves that they are drawn off from uniform projectile motion in straight lines, the curvilineal motions in which we find them all must arise.

The second law of Kepler, which is, that "the areas described round the centre by the radii vectores of the planets are proportionate to the time employed in describing them," like the first, was discovered by laborious investigation, and unwearied diligence. The limitation of it to planetary motion was, by subsequent observations, found to be incorrect, and it has since been applied to very many comets; it has been made use of to account for the force which connects the moon with this earth, the satellites with their primaries.

The times are shorter in proportion as the planet is nearer the sun, for the area of the triangle is then so much smaller; and we know that the time occupied by a planet in passing the different areas of its orbit, are to one another as the areas of the triangles terminated by these areas; and also that these areas are to one another as the time which the planet employs in passing through the area which terminates them. Sir Isaac Newton has proved that this law is a necessary consequence of the projectile force, combined with the attractive force which retains planets in their orbits. From the circumstance that the duration of the planetary revolutions increases with their mean distances from the sun, Kepler suspected that they were related to these distances by some proportion, and from his lively fancy and disposition to trace analogies, after a great number of trials ascertained, that "the squares of the times of the planetary revolutions are to each other, as the cubes of their distances from the sun."

If we compare the square of the time which is occupied by any two of the primary planets in completing their orbits, we shall find that the same relation subsists between these two squares, as between the cubes of the mean distances of these two planets from the sun. If we can ascertain, therefore, the time which any two planets take to revolve round their common centre, we may with ease and precision determine at what distance they are respectively from the sun. Thus, the planet on which Kepler employed himself so much in his investigations, (Mars,) is nearly four times as far distant from the Sun as Mercury, and his periodic revolution is nearly eight times that of Mercury:—therefore, $4^3 = 64 = 8^2$. To instance another: if we suppose the planet Venus to revolve round the Sun in 224 days, and the earth to perform the same revolution in 365 days, and if the mean distance of the earth from the Sun be 95 millions of miles, then as $365^2 : 224^2 :: 95{,}000{,}000^3$ to a fourth proportional, which will represent the cube of Venus's mean distance from the Sun; the cube root of which being taken, will give about 68 millions of miles for the mean distance of Venus from the Sun.

Incalculable advantages have flowed from the application of these three laws to the purposes of astronomy. They were followed out and improved by Sir Isaac Newton, who has drawn from them many important results; indeed he acknowledges his obligations to them, as having furnished the means of investigation and improvement.

Such are the laws which have finally led to the important discovery of universal gravitation, and which led us naturally to consider the Sun as the centre of a force, which diminishes as the square of the distance increases, and which possesses an attractive power.

X. X. X.

ON THE MOTION OF THE PLANETS.

WHEN I first entered on the study of the principles of astronomy, it seemed to me a little strange that the mere force of the sun's attraction should act with such power in counteracting the centrifugal force of the planets in their revolutions round him. Upon examining more minutely into their motions, and seeing that they all moved round the sun in one direction, and in the same with that of the sun's motion upon his axis, nearly all in a plane, I was imperceptibly led into the opinion of the famous Descartes, with regard to the mechanism of the solar system. Some time after I had formed this opinion, I happened to see an attempt made to refute this system in Fergusson's lectures on Mechanics, by what is called a whirling machine. But on examining closely into the nature of it, and comparing its mechanism with that of the solar system, I found that it is no more capable of refuting the Cartesian system than a thrashing machine is; for the line of the axis of the ball which moves on the whirling board is at right angles with the axial line of the board, whereas those of the planets are not so with regard to the line of the sun's axis; and I think that if the axial line of any of the planets were at right angles with the line of the sun's axis, they would fly away from him in spite of his attraction, in the very same manner as the ball flies away from the centre of the whirling board. Until, therefore, a machine can be so constructed, that the axial line of the ball will keep in the same position with regard to the axial line of the board, as those of the planets do to that of the sun, the Cartesian system cannot be refuted; and it appears to me, not to be merely by the sun's attraction that the centrifugal force of the planets is counteracted; but by the joint power of the sun's attraction, and the natural tendency which the rotatory motion of a body moving round a central one, has in keeping it from being carried away by the centrifugal force, which acts in the same manner as the rotatory motion of the curling stone does in counteracting the tendency which a declivity of the ice has in drawing it away from the straight line in which it would have otherwise moved.

More proofs might be advanced in favour of the above theory; however, I shall let this suffice for the present, until I see what others more competent to the task may say upon the subject.

R. B.

Darvill, 10th June, 1825.

ON DRAWING, AS A BRANCH OF EDUCATION.

I HAVE often thought that the art of Drawing, as a branch of education, has been greatly overlooked among us, especially that kind of it which is most useful in the common affairs of life, and which is equally, if not more easily acquired than writing. Its value, when properly understood, is incalculable, and the want of it has often been complained of, and severely felt, in almost every situation, particularly by mechanics, manufacturers, men of science, travellers, &c. If knowledge be power to any individual or community, to increase that knowledge is certainly to add strength to the country, and, on the other hand, to withhold it, is as certainly to deny it a great blessing. This will appear in a very striking point of view if we consider what benefit it would have been to the country, had those who first planned our parish schools, or endowed our charitable institutions, ordained that drawing should have been one of the branches taught in them. Had such been the case it would now have been generally practised to a certain extent, by all descriptions of people, and its advantages universally felt, whilst it would, at the same time, have contributed not a little to the honour of our national character. In this point of view, one would suppose that it is a matter not unworthy the notice of our constituted authorities, and that magistrates, clergymen, heritors, &c. who have occasion to appoint teachers to situations, might enjoin it or recommend it to be taught at least one day in the week, instead of writing, in those seminaries under their direction. By their doing so, it would soon spread through the country, and instructors would multiply as it spread. No doubt teachers who have not previously made it a study, will be averse to introduce it into their schools, from a fear of exposing their want of skill in it; but this should not have any great weight with them, as where there is no pretensions on their part, no instructions can be expected from them; besides, they will by practice learn it themselves. This we are warranted to assert, as teachers who have made the experiment have really come at a certain degree of facility in using the pencil, from superintending and assisting children who were learning it; and they aver, that if proper patterns, &c. be given to copy, and attention paid to the time that they should practice, young people being naturally so fond of it, and the imitative faculty in them so strong, that they will come at it without any instruction at all. In this case it would be a great matter, if the plan could be fairly tried and acted upon, as it would render the art familiar, and add a new branch of education to those already taught, that would prove rather a gratification than a disagreeable task to the children.

Yours, &c. A. B.

◆

GENTLEMEN,—If the following results are worth a place in your valuable Magazine, their insertion would give me great pleasure, and might perhaps prove interesting or useful to such of your readers as are fond of mathematical calculations.

Diameter of a circle,........................ = 1.
Circumference, ... = 3.14159265358979
Area,.. = .78539816339745
Side of inscribed equilateral triangle,... = .86602540378443
Circumscribed ditto, ... = 1.73205080756887
Inscribed square,.............................. = .70710678118654
Inscribed pentagon, ... = .58777525129225
Inscribed heragon, ... = .50000000000000
Side of equilateral triangle, ... = 1.
Diameter of circumscribed circle, ... = 1.15470053837925
Diameter inscribed ditto, ... = .57735026918962
Inscribed square,.............................. = .46530242951192
Side of a square, ... = 1.
Diameter of circumscribed circle, ... = 1.41421356237309

MECHANIC.

Glasgow, 22d June, 1825.

ABERDEEN MECHANICS' INSTITUTION.

GENTLEMEN,—On looking into No. LXXII. of your useful miscellany, it is gratifying to find, from "the History of Mechanics' Institutions," that the good work continues to prosper: that these establishments will become general there can be no doubt; their practical utility is becoming more and more evident, and the opposers are now confined to a few ignorant, narrow-minded bigots, a class far from numerous in this country.

It is matter of regret, however, that the account which is given of each society is not more particular and extended. Were you occasionally to appropriate a page to the rules and regulations of the several institutions, it would be a material assistance to those that are about to be formed, in enabling them to compare one with another, so as to draw out efficient rules.

Respecting the "Aberdeen Mechanics' Institution," your information is not quite correct. The constitution of the society was matured and lecturers appointed in December 1823, but by the inclosed "First Report of the Committee of Management," you will perceive that Mr. Steele DID NOT deliver lectures last winter on Natural Philosophy and Chemistry * in the Mechanics' Institution here; on

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* Mr. Steele lectured at the Aberdeen School of Arts: somehow or other we had been led to confuse the two together, and thus arose the mistake in saying he lectured at the Mechanics' Institution. We have received ample information from different friends in Aberdeen, with regard to both Institutions, and shall, in an early Number which we mean again to devote to information on Mechanics' Institutions, give a particular account of both.

the contrary, it is quite certain that Mr. Steele was never present at any one meeting of the Institution, nor was he ever present at any of the lectures. Besides the lectures recorded in the report, other courses on Geometry, Physical Geography, and particular branches of Natural Philosophy, have been delivered during the winter. At present, an extensive course of Natural Philosophy and Mechanics is delivering to a crowded audience, by one of the professors of King's College, and a course of Chemistry and its application to the Arts, will be commenced by another professor of King's College in a few weeks. The instruction in particular branches of the Mathematics will be resumed when these close, so that the Institution will continue to be open during the whole year.

The library now contains upwards of eight hundred volumes of books, *exclusively on scientific subjects*, the collection of models and apparatus is considerably increased, with funds sufficient to extend both. Thus, in the short space of eighteen months, the Aberdeen Institution is in as forward a state as any in the country, and may now be said to be permanently established.

E.

Aberdeen, 14th June, 1825.

ON THE PRACTICABILITY OF INVENTING A SELF-ACTING MULE.

GENTLEMEN,—I observed in your valuable Magazine of 18th June, your observations on Query from a Mechanic, regarding the practicability of a self-acting mule; but I think no great difficulty should be in the way where such *important* advantages are to be derived. I think its original construction of *infinite* more difficulty than the proposed improvement, and also think it worth the pains of some of your ingenious Correspondents to try it upon the simplest plan, with a small model. I should wish you to be so good as lay the above before some of them. Could the fly of the spinner not be made to work something like the regulator of a self-floating machine for rollers?

I am, Yours, &c.
AN ENQUIRER.

Barrhead, 9th July, 1825.

[We understand that two patents have been taken out for self-acting mules, but have not seen either them or the specifications.]

M. DUPIN'S ADDRESS TO THE MECHANICS OF PARIS,

Delivered in November last, at the Conservatoire Royal Des Arts et Metiers.

[Continued from page 367.]

A crowd of moral advantages have followed the disappearance of the single vice of drunkenness. By becoming temperate, the artizans have acquired the power of becoming economical; the future enters into their thoughts; they feel that labour can be made sufficient for their present and future subsistence. They have accustomed themselves to place in savings'-banks the overplus of their salary, during the time when labour is abundant and well rewarded, in order to assist their wants during the time when work is scarce and unproductive, and on other occasions when they are ill, infirm, or weak. Thus it is seen, that they are better clothed than formerly: their dress is neater, and their linen cleaner. Their morals are equally improved. They have formed themselves to habits of prudence, and of moderation, as well as of foresight. In other words, they are become in every respect better men. Animated by a more elevated spirit, they have quickly acquired the noble determination to become able to maintain themselves, and to free themselves for ever from the degrading assistance of mendicity, or of charities granted by a tax for the relief of the poor.

Attentive observers have remarked, that in London, no individual of the working classes ever debases himself by asking alms: he neither suffers it in his wife, nor in his children. He is influenced by that pride which can endure indigence and all the privations of life, rather than stretch out a hand to obtain help without having earned it. One may thus easily explain how it happens, that in a city such as London, where food is so dear, and rent so extravagant; where so many sources of misery are accumulated with so much luxury, the poor-rates for the city do not amount to half of the tax collected in the richest agricultural counties.

A parliamentary inquiry, which is not yet finished, but of which a part is already known to the public, presents to us, respecting the amelioration of the industrious classes, facts authentically established, and worthy of all our attention.

Behold the result of the examination of one of the principal mechanists in the city of London. "Within the last thirty years," says Mr. Galloway, "the character and tone of the English artizans and mechanics have undergone a decided improvement: not only in knowledge, but in conduct.—This is the fact," continues the skilful mechanician, "in my manufactory, and I will state the practice which I adopt. I have found, from the mode of managing my business, by drawings and written descriptions, a man is not of much use to me, unless he can read and write. If he apply for work, and says he cannot read and write, no more questions are asked. But if he can read and write, the next question is, where do you come from? and what are you? and can you produce a character? Unless he conforms with these inquiries, I cannot employ him." By which means, full of wisdom, this manufacturer has rendered general among the workmen under his direction, a degree of good conduct, and a deportment such, that any person visiting his manufactory, will see as much good order and regularity in the men, as in the better classes of society. He does not admit obscene and vulgar language to be used in the manufactory. The men themselves fine those who behave improperly, and their general character has improved; and he has found invariably, that the men who are best educated, have always conducted themselves the best, and have most completely conformed to the regulations of the factory; whilst the ignorant have been invariably refractory, obstinate, and difficult to manage."

"My workmen," says he, further, "do not recur to parochial aid; they would consider it the greatest indignity that could be offered to them while in health and employment."

This tax is further useless in the manufactory of this skilful mechanician, because a fund is there formed for the assistance of the sick: a fund which procures for them, in the most economical manner, certain assistance under every possible accident. One shilling is retained weekly from the wages of each workman. When one of them becomes ill, he receives immediately from this fund, one pound weekly. The simple labourers pay only half, and receive only half the sum last mentioned, when they are indisposed. Every year, at Christmas, the workmen appoint inspectors, who audit the accounts of the association. Soon afterwards, if the receipts exceed the expenditure, the surplus is divided amongst all the workmen, according to the proportion of the sums which they have placed in this bank for their support. The existence of this bank is sufficient to render the manufactory of which we are speaking, preferable to those of the same description which do not possess one.

Should we wish to form an idea of the advantages which the manufacturer who, with so much zeal, interests himself in the condition of his workmen, in their instruction, and in their prosperity, has derived from his care, so truly honourable to human nature, it will be sufficient to quote one of the questions which were addressed to him by the Committee of the House of Commons, before whom he was called to give evidence.—"What is your summary mode of enforcing performance of a contract, if any men decline fulfilling it?" "We have not had, in twelve years, one single dispute, although I have employed, within that period, from one thousand to fifteen hundred men." This answer is the most beautiful apology for the principles adopted by Mr. Galloway for directing his labours and instructing his workmen.

Many other manufactories of machines

are conducted with the same wisdom as that of the engineer, whose views and opinions we have already exhibited. This wisdom produces everywhere the same satisfactory results. There still exist, however, some establishments imperfectly regulated in this respect; they have preserved, until this period, the routine, and the numerous defects which have been noticed in the English manufactories for the last thirty or forty years; but their number diminishes with rapidity, partly by their want of success, and partly by the force of good example. The era will soon arrive when British industry will govern its labourers with feeling and intelligence only, and no longer by fear or by prejudice.

Let us now examine the labouring class under the point of view which the progress of its instruction presents.

In the year 1817, when I visited Scotland, I was every where struck with the instruction generally diffused amongst this interesting class of men. I have cited numerous and remarkable examples of this diffusion. I have endeavoured to direct the public attention to an institution of which I have so sensibly felt the importance. It is a school for teaching the theory of the mechanical and chemical arts; intended not only for the directors of the workshops, and the rich manufacturers, but intended particularly for the simple workman. I have delineated the advantageous effects produced by this institution upon the industry of the city of Glasgow.

The plan offered by the Andersonian Institution of Glasgow, is now imitated in London, in Edinburgh, in Aberdeen, in Leeds, in Manchester, in Birmingham, in Newcastle, in Liverpool, in Lancaster; and it will be followed successively in all the towns of Great Britain.

Already the English mechanics feel a profound conviction of the great utility of scientific knowledge for directing them in the conduct of the operations which they ought to perform. Let us say, and repeat it incessantly, the greatest part of them know how to read, write, and cypher. Many even are prepared to draw correctly the machines or the objects which they construct; and to give geometrical elevations, plans, and sections of them. They read periodical works, published respecting the arts which belong to them; and technical works published in numbers, for threepence, fourpence, and sixpence, weekly. I shall notice particulary the Mechanics' Magazine, of which sixteen pages appear weekly, and the journal called the Chemist, which appears also in similar numbers, sold at the same moderate price.

It is to Dr. Birkbeck, professor of mechanics in the Andersonian Institution, that Great Britain is indebted for the extension of scientific instruction to the working classes. The first prospectus of the course of lectures, which he opened with this intention in the city of Glasgow, contains views and reflections equally just and profound: their utility induces me to communicate them to you. I shall endeavour to realize for you, what the learned Scotch professor has so happily accomplished for his pupils.

"In the prosecution of this design," says he, "I shall deliver a series of lectures upon the *mechanical properties of solid and fluid bodies*, abounding with experiments, and conducted with the greatest simplicity of expression and familiarity of illustration, solely for persons engaged in the practical exercise of the mechanic arts: men, whose situation in early life, has precluded even the possibility of acquiring the smallest portion of scientific knowledge, and whose subsequent pursuits, not always affording more than is necessary for their own support, and that of their dependant connections, have not enabled them to *purchase* that information, which curiosity, too active for penury wholly to repress, or the prevailing bias of their natural genius might prompt them to obtain. I am by no means sanguine in my expectation, that by a course of instruction, such as I have now proposed, one artist will be directed to the discovery of any thing which is essential or important in his particular department, how much soever it may be connected in principle with the subject to be discussed. I am too well aware that the best contrivances in every branch of the mechanic arts, have resulted, and must still continue to result, from the observation of practical defects, and from the gradual application of suitable means, dictated by practical maxims, to obviate or remove them. But whilst my slight acquaintance with the subject has afforded this information, I have become convinced that much pleasure would be communicated to the mechanic in the exercise of his art; and that the mental vacancy which follows a cessation from bodily toil, would often be agreeably occupied by a few systematic philosophical ideas, upon which at his leisure he might meditate. It must be acknowledged too, that greater satisfaction in the execution of machinery must be experienced, when the uses to which it may be applied, and the principles upon which it operates, are well understood, than where the manual part alone is known, the artist remaining entirely ignorant of every thing besides. Indeed, I have lately had frequent opportunities of observing, with how much additional alacrity a piece of work has been undertaken, when the circumstances were such as I have now stated.

"Perhaps to some it may appear that the advantages derivable from these lectures will be inconsiderable, or even, that they will be disadvantageous, on account of the extent of the subjects they embrace, and because those to whom they are addressed do not possess the means, or enjoy the opportunities, calculated for engrafting upon the elementary truths which they learn, the extensive researches of the illustrious philosophers, by whom the boundaries of science have been enlarged. Whatever the arrogance of learning may have advanced in condemnation of superficial knowledge, and however firmly I may be persuaded that the people cannot be profound, I have no hesitation in predicting, that vast benefit will accrue to the community, by every successful endeavour to diffuse the substance of great works, which cannot be perused by the people at large, thereby making them reach the shop and the hamlet, and converting them from unproductive splendour, to useful though unobserved activity."

The experience of twenty-four years has fully demonstrated the excellence of these views, and the justice of these thoughts: the workmen of Glasgow possess at the present moment a practical knowledge, and a dexterity celebrated in the whole of Great Britain.

[To be continued.]

MISCELLANIES.

Log Book.—*Coelbren y Beirdd*, or *The Wood Memorial of the Bards*, is what they formerly used to cut their memorandums upon; such as the ancient wooden *Almanacks* were; or *Staffordshire Clogg*,* or *Log*. Hence originated the *Log Book*, which is used by the sailors. Also, there is a similiar thing called a *tally*, or a piece of wood cut with indentures, or notches, in two corresponding parts; of which, one was kept by the creditor, and the other by the debtor, as was formerly the common way of keeping all accounts, (and is still used by the brewers, and the milk-sellers.) Hence, likewise, is derived the *Tally Office* (of the Exchequer, in London,) and a *teller*; and probably, a *Talisman*: from the Welsh word *talu*, to pay; or from the French word *taille*. See Kennet's Glossary to his Parochial Antiquities; and Plot's History of Staffordshire, p. 418, and 420.

The Trumpet.—The trumpet is said by Vincentio Galileo, in his Dialoge della Musica, page 146, to have been invented at Nuremberg; and there is extant a memoir which shows that trumpets were made to great perfection by an artist in that city, who was also an admired performer on that instrument: it is as follows:—"Hans Meuschell, of Nuremberg, for his accuracy in making trumpets, as also for his skill in playing on the same alone, and in the accompaniment with the voice, was of so great renown, that he was frequently sent for to the palaces of princes the distance of several hundred miles. Pope Leo the Tenth, for whom he had made sundry trumpets of silver, sent for him to Rome; and, after having been delighted with his excellent performance, dismissed him with a munificent reward."

Expansion of Ice.—That ice expands from the centre of the pond, or vessel, towards the edge is evident; for when water freezes in an earthen, or even metal, vessel, the expansion from the middle to the sides, is so strong as to break it, if due care be not taken. When an egg is frozen it will burst; and sometimes, also, trees have split from the same cause. The precise nature of the change produced on air by excess of heat, is not perhaps thoroughly understood;

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* The *Staffordshire Clogg* seems to be a corruption of the Welsh word *cyflog*; that is, wages, or hire; which is still customary among the labourers in Wales, to mark every day's work upon a stick.

but it is supposed, that a partial combustion of animal and vegetable matter takes place; it, however, produces a very sensible effect on any person remaining a considerable time in air that has undergone this change.

Wales.—*Cymbru*, Cambria, or Wales, according to the Welsh Chronicles, had its name from *Camber*, one of the three sons of *Brut*, (or *Brutus ab Silius*, which hero is mentioned by Homer to have conquered Aquitain;) the other two sons of *Brut* were *Locrin*, whence came the name of *Lloegr*, (now England,) as well as that of *Albania*, from *Albanie*, who possessed Scotland.—*Brut y Brenhinoedd.*

Remedy against the bite of Serpents.—The shrub *guaco*, a sort of climber, or pliant willow, found in the warm and temperate regions of Santa Fé, about 45° N. lat. not only possesses the property of neutralizing the venom of the rattle-snake, and other serpents, whose bites prove fatal in the course of a few minutes, but may be used as a prophylactic, and with such efficacy, that some doses of the juice of the pounded leaves, properly administered, will be a complete antidote against the bite of these reptiles.

Chinese Saw.—A saw has been introduced into France and the Colonies, which will saw the largest and longest trees when laid on the ground, and not placed on stocks, as is the common practice. This instrument, originally of Chinese invention, has not been hitherto much known; and though already found to be very useful, is susceptible of much improvement.

That the *Salmon may be neutralized as a Fresh Water Fish*, has been inferred by Mr. N. Mill, who, at the period when the fry of the salmon were retreating to the sea, caught a good many of them, which measured about four inches in length, and put them immediately into a fish-pond, about thirty yards square, and three to four feet deep, with a clay bottom, supplied by a stream of water; and about twelve months afterwards he found there young salmon eight inches long, and apparently healthy, though lean: indicating, that in more ample waters, where they may range at large and procure that food and situation most congenial to their habits, they would attain their natural size.

Captain N. J. Gordon.—Letters have been received which confirm the death of Captain Gordon, of the Navy, who had undertaken to ascend the Nile, and to penetrate to the springs of Bahr-el-Abiad. He had reached Villet-Medinet, one day's journey from Sennaar. The loss of this distinguished officer adds another to the long list of victims to the adventurous spirit of African discovery.

The *Destruction of Insects* prejudicial to gardens, has been accomplished, by freely using the following mixture as a wash for the stems and branches of plants, in open weather, in January or February, *viz.* Tobacco leaves, cut small, are infused in hot water, but not boiled, which would dissipate the essential oil; in the infusion gum arabic is dissolved, and the flour of sulphur intimately mixed therein. This has also been found a valuable pickle for seed wheat.

The *Colouring Matter extracted from Red Cabbage Leaves* may be preserved, as a chemical test, for years; if the leaves be digested in warm alcohol, the latter distilled off from the solution, and watery evaporation continued in a gentle heat, until the extract be reduced to a syrup. This may be preserved in well-stopped phials for years; and when wanted, this syrup may be diluted with water to the proper intensity of colour. From the alcoholic solution-test, papers may also be prepared.

NOTICES TO CORRESPONDENTS.

Our Correspondents must rest satisfied another week.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

Published every Saturday, by W. R. M'Phun, 155, Trongate, Glasgow, to whom Communications (post paid) must be addressed.

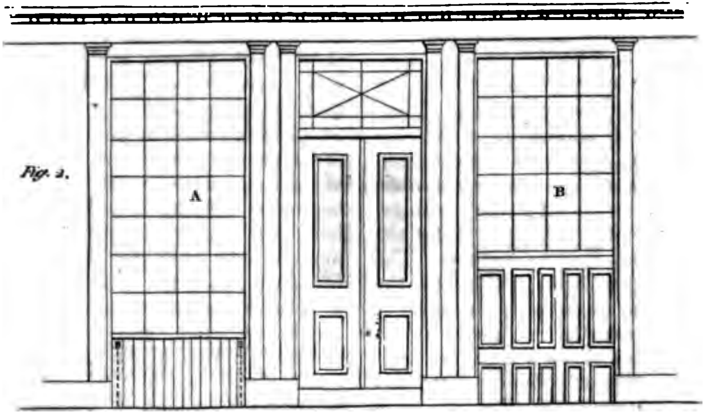
CURLL, PRINTER.

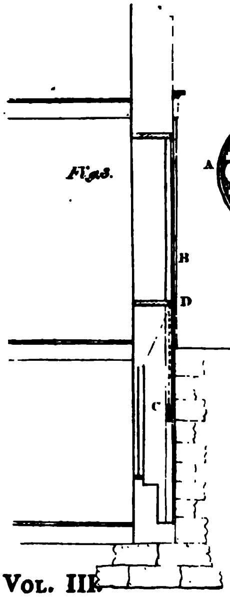
THE GLASGOW
MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

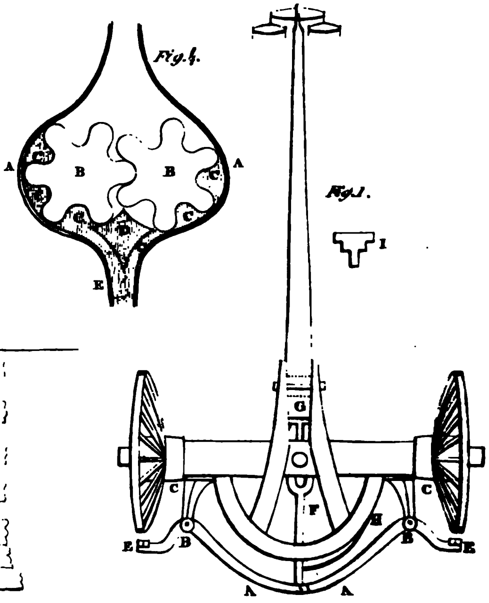
" Bacon, like Moses, led us forth at last;
The barren wilderness he past;
Did on the very border stand
Of the blest promised land;
And from the mountain top of his exalted wit,
Saw it himself, and showed us it."

No. LXXXIII. *Saturday,* 23*d July,* 1825. Price 3*d.*

PLAN OF SHUTTERS FOR SHOP WINDOWS; IMPROVED DRAG FOR CARRIAGES, &c. &c.







Swan Sc.

IMPROVED DRAG FOR CARRIAGES.

The velocity with which carriages descend hills is the terror of all travellers; innumerable accidents are daily occurring by their upsetting from this cause; and even where no accidents happen, where the carriage escapes being overthrown and dashed to pieces, and the frightened passengers are so lucky as to escape having their joints dislocated, their bones broken, or their brains dashed out, the feelings are much harassed by the manner in which the shaft horses are distressed and overpowered. When a carriage is descending a hill, the shaft horses, instead of being obliged to pull, are forced to exert their strength in backing the carriage, and preventing its descending too swiftly from its own impetus. The shaft horses being yoked to the pole of the carriage by the collar or brechem, the whole weight is thrown on the back of their necks by their efforts to retard the descent; and they are often thrown back on their hams and severely injured. Every one must recollect the feelings with which they have witnessed the violent and painful exertions made by horses in such a situation. Many attempts have been made to afford a remedy to this, by the application of a drag to retard the motion of the wheels; but few, if any, of these plans have come to be any way generally adopted.

The following plan has occurred to us, as one more likely to be useful than any other we have seen; and it has this advantage, that it acts of itself as soon as the carriage begins to descend a declivity. Fig. 1 of the plate, is a representation of the two fore wheels, axle, and pole of a carriage, to which is affixed our improved drag. A, A, are two levers, working on the fulcrums B, B, which fulcrums are attached to the fore axle at C, C. At the point of these levers are fixed two friction blocks of wood E, E, and the other ends of the levers are fixed to a maleable iron bar F, which passes through the swey bar and boxing of the fore axle, with prongs on each side of the centre bolt, which connects the fore and hind wheels together, meeting the end of the pole where it is attached to the carriage. The dotted lines at G, show an elongated hole in the pole where the bolt passes through that attaches it to the carriage, which is intended to allow the end of the pole to press upon the points of the iron bar. When the carriage begins to descend a declivity, the horse, in its attempts to retard the motion, pulls back the pole, which pressing upon the points of the iron bar F, pushes out the ends of the levers A, A, and thus brings the two friction blocks E, E, into contact with the fore wheels, and retarding their motion, lessens the velocity of the descending carriage. In order to remove the pressure, and bring back the levers to their original position, when the carriage arrives at the bottom of the hill, a spring H, H, is fixed on the swey bar attached to the end of the bolt F. A disadvantage attending the application of this drag is, that when the carriage is wished to be put back on level ground, the pressure would be applied to the wheels, and the carriage could not be moved backwards; in order, however, to remedy this, a block, I, will be necessary to be inserted between the front of the axle and the end of the pole, so as to prevent the pole acting on the end of the bar F, except when required; and this piece of wood could be removed when necessary, at the top of a hill, by the driver, by means of a small rod, and could be replaced at the bottom of the hill without his being obliged to descend from his seat. This drag could be with ease applied to carriages already constructed as well as to new ones; and we would really recommend that its use should be attempted by some of our readers, when we feel convinced its utility will be ascertained.

PLAN OF SHOP WINDOW SHUTTERS.

GENTLEMEN, — According to Mr. Saul's wish, in No. LXXIV. Vol. III., I have taken the liberty of presenting you with a sketch of the elevation and section of the window in the Candleriggs: wherein A, fig. 2, represents the window when the shutter is down; and B, the same, when half-way up. Fig. 3, is a section, showing B, the shutter, half-way up; and C, its counterpoise, suspended over the pulley, D.

I am, yours, &c.

J. A.

South Hanover Street,
23d May, 1825.

You may let Mr. Saul know, that his new Water Trap has been in constant use here, for upwards of, I suppose, forty years.

HINT OF A ROTATORY STEAM ENGINE.

GENTLEMEN,—I am no engineer; yet, it has often occurred to me, that the steam engine (notwithstanding its improved and almost perfect state) might be made more compact, and of comparative little weight, if the steam could be applied to the turning of a wheel, instead of working vertically in a cylinder, as it at present doth. If you think the following observations worth inserting in your Magazine, perhaps they may turn the attention of some of your enlightened and experienced engineers to look into its practicability, which if it hath been done, I have not yet seen any account of.

Description of the plate.

Fig. 4, is a section of the pipe and case for the fluted rollers to work in. A, A, is the case for the rollers. B, B, are two rollers fluted in such a manner that the one fits exactly into the other, the opposite sides of which, in turning, work closely in a plate, exactly made to suit the circle of the rollers. At C, the steam is pressing on the extremities of the rollers, and forcing them up in the sides, and down in the middle, in the act of turning. D, is a division to keep the steam from having force to go to the rollers where they join in the middle, and to guide it up the sides. E, is the pipe from the boilers. F, is the pipe to conduct the steam into the funnel.

The greatest difficulty that I see in the above operating is, whether the steam will have sufficient force on the rollers to turn them; the division will keep the steam in the middle from having any force to work against the insides, and they will not take any thing down. If the proposal would do, it would, I think, be very answerable for land carriages, but I refer the whole to your better judgments.

Yours, &c.

J. WHYTE.

Easdale, 10th June, 1825.

ESSAYS ON BLEACHING,

By James Rennie, A. M. Lecturer on Philosophy, &c. &c., London.

No. III.—CHEMICAL AGENTS USED IN BLEACHING.

SECTION I.—*Continued.*

The qualities of water are not of difficult determination, although a chemical analysis of them is none of the least difficult problems in chemistry. When water is nearly pure, (for no native water is entirely so,) it is colourless and transparent; has no smell, and scarcely any taste. If water have these qualities, it may be pronounced good without farther trial. If it is wished to examine it more minutely, its specific gravity must be taken, which should not much exceed that of rain or distilled water; indeed, the lighter it is the better. Its hardness may be tried by pouring half an English pint or so into a glass tumbler, into which has been previously put a thin slice of Spanish soap, and allowing it to stand for half an hour. If it contains, in solution, any metallic or earthy salts, the soap will be decomposed, and become ropy and curdled. If it be soft, on the other hand, it will be somewhat whitened, but the whiteness will be equally diffused through the whole. Or if it is required to try water instantly, it can be done by a test made by dissolving a little Venice soap in alcohol. The salts of lime, the most common earth which is to be found in water, are easily discovered by the copious white precipitate which they afford, when treated with oxalate of ammonia. Iron may be at once detected, by dropping into the water a small quantity of prussiate of potass, or tincture of galls. If iron be present, the prussiate will produce a blue colour in the water; the tincture will first produce a purple, which will afterwards change to a *black.* Sulphate of iron, the most common state in which it occurs in our waters, may be discovered by nitrate of barytes, which, in this case, gives a yellow precipitate. On this principle, the importance there is in the choice of water for bleachers, may be strikingly illustrated. Take half a pint of distilled water, add to it a single drop of solution of the sulphate of iron, and a single drop of the tincture of galls, and stir it with a glass rod. It will now present but a very slight change of colour, but add to it half a pint of spring water, and the whole will become instantly black. I have not left room to detail the mode of finding, by analysis, the proportions of substances contaminating water; for this I refer to Thomson's Chem. IV. 212.

I shall conclude the subject of water, by mentioning some of the expedients by which such as may be unfit for the bleacher's use may be improved. I formerly remarked that hard waters have a considerable power of checking the putrefactive fermentation. Now, this holds equally *vice versa,* and can easily be turned to good account in rendering hard waters soft, for abundance of waste vegetables can at all times be easily procured. It is this that renders soft the waters of most lakes, and rivers arising from lakes; for, as they abound in aquatic plants, which are continually destroyed and reproduced, a great quantity of vegetable matter runs into fermentation and softens the water. The effect may be accounted for by the combination of the ammonia and sulphuretted hydrogen arising from the decomposed vegetables, with the earthy and metallic salts which are contained in the water, and render it hard. Dr. Priestley, vol. II, p. 185 of his Experiments on Air, has related a fact strongly illustrative of what we here recommend. He there states on the authority of Mr. Garrick, that the public reservoirs at Harwick are commonly very foul on their sides and bottoms, but contain water which is both wholesome and pleasant, provided that they are *not cleaned*, for whenever the fæcula, together with the mosses and other aquatic vegetables are removed by cleaning, the water becomes totally unfit for use till these matters again accumumulate in sufficient quantity to purify them. Plants even seem to purify water while *growing* in it; a fact, for the knowledge of which we are indebted to Priestley and Ingenhouz. This seems to be particularly the case with the byssi and confervæ, which fortunately abound in all our waters, unless pains be taken to prevent their growth, under a false notion of cleanliness. (See Priestley on Air.)

Water containing lime may be improved by exposing it in shallow reservoirs to the action of the atmosphere; in which case the carbon of the air unites with the lime, and precipitates it, or causes it to float on the surface. When such water is to be used for any nicer purpose, such as for diluting acids, it may be improved by the method employed by dyers. Put twenty-four bushels of bran into a tub or vat which will contain about ten hogsheads; fill a large boiler with the hard water, which, when just ready to boil, pour into the vat. The acid fermentation will soon commence, and in twenty-four hours it will be ready for use. Berthollet conceives that the acid acts by decomposing the carbonate of lime and magnesia, from which, its acid, being more powerful, disengages the carbonic acid; and that in this way the earthy sediment which is occasioned by boiling is prevented from taking place. (Edin. Encycl. art. Dyeing.)

When water is rendered hard by the presence of sulphate of lime, it may be purified at a comparatively small expense, by a solution of barytes, for the sulphuric acid having a greater affinity for the barytes than for the lime, will leave the latter to unite with the former.* The solution should be dropped in by degrees, in small portions, till it produces no farther precipitate. If too much should happen to be put in, and this will be shown by its giving a vinous colour to paper stained as Brazil wood or Fernambouc, (Ann. Chem. XXIX. page 321,) it may be readily precipitated by exposure to the atmosphere, whence it will draw carbonic acid, and form a carbonate. When barytes is not to be had, hard water may be softened by the addition of pearl ash or crystals of soda, either of which will combine with the sulphuric acid, and disengage the lime, but not so perfectly as the barytes; besides, the expense of the purification would exceed the advantage derived from it. A cheaper substitute, however, may be found in stale urine, which may be gradually poured into the water till the object is attained. Its offensive odour may be corrected by the previous addition of quick-lime, a mode of sweetening which does not seem to have been known to the Romans, who obliged their scourers to reside in unfrequented parts of their cities. (Plin. Hist. Nat. XXVIII. 5, 6. Parkes.)

The solutions of iron which occur in our waters, are generally sulphates, and are most injurious in every part of the process of bleaching. Water so contaminated must be drawn into a cistern and purified as in the last case, by adding a solution of pure barytes, which will deprive the iron of its solvent, when it will consequently precipitate. The process takes several hours, but when expedition is required, two reservoirs may be constructed, and the process may be commencing in the one, while it is finishing in the other. The workmen, however, ought to be cautious of adding too much of the solution, as, in this way, the water may be left in as bad a state as at first. If the cisterns, however, are made sufficiently shallow, exposure to the air will throw the superabundant barytes to the bottom. Mr. Parkes has ingeniously suggested that, in works in which large steam engines are employed, a considerable quantity of distilled water might always be commanded from the waste steam. "It would only require," he remarks, "a proper receptacle to condense it, and its advantage to the bleacher of fine calicoes for printing would be incalculable." I would add to this ingenious, and evidently practicable suggestion, that although the quantity produced in this way was not very considerable, even a small quantity of pure water produced daily, and *added* to the common water in use, would greatly increase its purity by diluting the contaminating substances.

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* See Nich. Journ. I. 535. The mode of preparing this solution is given by M. Robinquet in the sixty-second tome of the Annales de Chimie.

After all, these expedients are but imperfect, and, in every case, expensive and troublesome. The manufacturer, therefore, cannot be too strongly impressed with the importance of forming his establishment where none of them are necessary—where he may have a constant and copious supply of good soft water.

LORD BACON AND HIS PHILOSOPHY.

"History," says Lord Bacon, "is natural, civil, or ecclesiastical, or literary; whereof the three first I allow as extant, *the fourth I note as deficient!* For no man hath propounded to himself the general state of learning, to be described and represented from age to age, as many have done the works of nature, and the state, civil and ecclesiastical; without which, the history of the world seemeth to me to be as the statue of Polyphemus with his eye out, that part being wanting which doth most show the spirit and life of the person. And I am not ignorant that in divers particular sciences, as of the Jurisconsults, the Mathematicians, the Rhetoricians, the Philosophers, these are set down as some small memorials of the schools, of authors, of books; so likewise some barren relations touching the invention of arts or usages. But a just story of learning, containing the antiquities and originals of knowledges, and their sects, their inventions, their traditions, their divers administrations and managings, their oppositions, decays, depressions, oblivions, removes, with the causes and occasions of them, and all other events concerning learning throughout the ages of the world, I may truly affirm to be wanting. The use and end of which work I do not so much design for the curiosity or satisfaction of those who are lovers of learning, but chiefly for a more serious and grave purpose, which is this, in few words, 'that it will make learned wise in the use and administration of learning.' "—*Advancement of Learning, Book II.*

Though there are passages in the writings of Lord Bacon more splendid than the above, few, probably, better display the union of all the qualities which characterized his philosophical genius. He has, in general, inspired a fervour of admiration which vents itself in indiscriminate praise, and is very adverse to a calm examination of the character of his understanding, which was very peculiar, and, on that account, described with more than ordinary imperfection, by that unfortunately vague and weak part of language which attempts to distinguish the varieties of mental superiority. To this cause it may be ascribed, that perhaps no great man has been either more ignorantly censured or more uninstructively commended. It is easy to describe his transcendent merits in general terms of commendation; for some of his great qualities lie on the surface of his writings. But that in which he most excelled all other men, was in the range and compass of his intellectual view; the power of contemplating many and distant objects together, without indistinctness or confusion, which he himself has called the discursive or comprehensive understanding. This wide ranging intellect was illuminated by the brightest fancy that ever contented itself with the office of ministering to reason; and from this singular relation of the two grand faculties of man, it has resulted, that his philosophy, though illustrated still more than adorned by the utmost splendour of imagery, continues still subject to the undivided supremacy of intellect. In the midst of all the prodigality of an imagination which, had it been independent, would have been poetical, his opinions remained severely rational.

It is not so easy to conceive, or at least to describe, other equally essential elements of his greatness, and conditions of his success. He is probably a single instance of a mind which, in philosophizing, always reached the point of elevation whence the whole prospect is commanded, without ever rising to such a distance as to lose a distinct perception of every part of it. It is perhaps not less singular that his philosophy should be founded at once on disregard for the authority of men, and in reverence for the boundaries prescribed by nature to human inquiry; that he who thought so little of what man had done, hoped so highly of what he could do; that so daring an innovator in science should be so wholly exempt from the love of singularity or paradox; that the same man who renounced imaginary provinces in the empire of science, and withdrew its landmarks within the limits of experience, should also exhort posterity to push their conquests to its utmost verge, with a boldness which will be fully justified only by the discoveries of ages from which we are yet far distant.

No man ever united a more poetical style to a less poetical philosophy. One great end of his discipline is to prevent mysticism and fanaticism from obstructing the pursuit of truth. With a less brilliant fancy he would have had a mind less qualified for philosophical inquiry. His fancy gave him that power of illustrative metaphor, by which he seemed to have invented again the part of language which respects philosophy; and it rendered new truths more distinctly visible even to his own eye, in their bright clothing of imagery. Without it he must, like others, have been driven to the fabrication of uncouth technical terms, which repel the mind either by vulgarity or pedantry, instead of gently leading it to novelties in science, through agreeable analysis with objects already familiar. A considerable portion, doubtless, of the courage with which he undertook the reformation of philosophy, was caught from the general spirit of his extraordinary age, when the mind of Europe was yet agitated by the joy and pride of emancipation from long bondage. The beautiful mythology and poetical history of the ancient world, not yet become trivial or pedantic, appeared before his eyes in all their freshness and lustre. To the general reader they were then a discovery as recent as the world disclosed by Columbus. The ancient literature to which his imagination looked back for illustration, had then as much the charm of novelty as that rising philosophy through which his reason dared to look onward to some of the last periods in its unceasing and resistless course.

In order to form a just estimate of this wonderful person, it is essential to fix steadily what he was not, what he did not do, and what he professed neither to be nor to do. He was not what is called a metaphysician. His plans for the improvement of science were not inferred by abstract reasoning from any of those primary principles to which the philosophers of Greece struggled to fasten their systems. Hence he has been treated as empyrical and superficial by those who take to themselves the exclusive names of profound speculators.—He was not, on the other hand, a mathematician, an astronomer, a physiologist, a chemist. He was not eminently conversant with the particular truths of any of those sciences which existed in his time. For this reason he was under-rated by men of the highest merit, who *had acquired* the most just reputation, by adding new facts to the stock of certain knowledge. It is not, therefore, very surprising to find that Harvey, though the friend as well as physician of Bacon, "though he esteemed him much for his wit and style, would not allow him to be a great philosopher," but said to Aubury, "He writes philosophy like a Lord Chancellor," in derision, as the honest biographer thinks fit expressly to add. On the same ground, though in a manner not so agreeable to the nature of his own claims on reputation, Mr. Hume has decided that Bacon was not so great a man as Galileo, because he was not so great an astronomer. The same sort of injustice to his memory has been more often committed than avowed by professors of the exact and experimental sciences, who are accustomed to regard, as the sole test of service to knowledge, a palpable addition to its stores. It is very true that he made no discoveries; but his life was employed in teaching the method by which discoveries are made.

The writings of Bacon do not even abound with remarks so capable of being separated from the mass of previous knowledge and reflection, that they can be called new. This, at least, is very far from their greatest distinction: and where such remarks occur, they are presented more often as examples of his general method, than as important on their own separated account. In physics, which presented the principal field for discovery, and which owe all that they are, or can be, to his method and spirit, the experiments and observations which he either made or registered, form the least valuable part of his writings, and have furnished some cultivators of that science with an opportunity for an

ful triumph over his mis-
The scattered remarks, on
er hand, of a moral nature,
bsolute novelty is precluded
nature of the subject, mani-
st strongly both the superior
nd the original bent of his
anding. We more properly
than compare the experi-
in "the Natural History,"
e moral and political obser-
which enrich the "Ad-
ent of Learning," the
es, the Letters, the History
y VII., and above all "the
" a book which, though it
n praised with equal fervour
taire, Johnson, and Burke,
er been characterized with
xact justice, and such ex-
felicity of expression, as by
Stewart in his Discourse
l to the Supplement of the
opedia Britannica, where he
Under the same head of
may be mentioned the
volume to which he has
e title of Essays, the best
and most popular of all
rks. It is also one of
those where the superiority of his genius appears to the greatest advantage; *the novelty and depth of his reflections often receiving a strong relief from the triteness of the subject.* It may be read from beginning to end in a few hours; and yet, after the twentieth perusal, one seldom fails to remark in it something unobserved before. This indeed is a characteristic of all Bacon's writings, and is only to be accounted for *by the inexhaustible aliment they furnish to our own thoughts, and the sympathetic activity they impart to our faculties.*" It will serve still more distinctly to mark the natural tendency of his mind, to observe that his moral and political reflections relate to these practical subjects, considered in their most practical point of view; and that he has seldom or never attempted to reduce to theory the infinite particulars of that "civil knowledge," which, as he himself tells us, "is, of all others, most immersed in matter, and hardliest reduced to axiom."

(*To be concluded in our next.*)

IN, DESIGN, AND RELIGIOUS USE, OF THE PYRAMIDS OF EGYPT.

xtract the following interest-
er from the Kaleidoscope,
clever weekly periodical,
ed in Liverpool, which must
wn to most of our readers.
ticle was translated for the
scope from the French of
Dupuis.]

importance that we do not
ht of this consideration, that
o authors wrote the history
heavens, and particularly of
, as if they were writing the
of men, and that the people
every where understood it
real history, and considered
the hero of the story as a man who once had actually existed.

The priests generally did all that lay in their power to persuade the people, that the gods whom they adored had really lived, and had been princes, legislators, or men who had deserved well of their fellow-men. It might be that the priests wished to give a lesson to the chiefs among the people, by instructing them, that they could only aspire to the same glory by imitating the actions of these ancient princes; or it might be, that the priests sought to give encouragement to virtue in the people, by persuading them that formerly the sceptre had been the reward of services rendered to the country, and not a patrimony hereditary in certain families.

They showed the tombs of the gods, as if those gods had actually existed; they celebrated the different feasts, the intention of which was annually to renew the grief which their loss had at first occasioned.

Such was the tomb of Osiris, covered under those enormous masses known by the name of Pyramids, which the Egyptians raised to that star which dispenses daylight.

One of them has its four faces or fronts looking towards the four cardinal points of the world.

Each of these faces has a base of 110 fathoms, and each face forms an equilateral triangle.

The perpendicular height is seventy-seven fathoms, (according to the measurements given by Chazelles, of the Academy of Sciences.) It results from these dimensions, and from the latitude under which this pyramid is raised, that, fourteen days before the spring equinox, (the precise epoch in which the Persians celebrated the renewing of nature,) it would cease to throw any shadow at mid-day, and that it would not project any shadow again (at mid-day) until fourteen days after the autumnal equinox; consequently, the day on which the sun's southern declination was 5 deg. 15 min. (which happened twice a-year—once before the vernal equinox, and once after the autumnal equinox,) the sun would appear at mid-day precisely upon the very pinnacle of the pyramid. His majestic disk, placed upon that immense pedestal, would seem to repose upon it for some minutes, whilst his adorers, kneeling down at its foot, prolonging their view *along the* inclined plane of the northern face of the pyramid, contemplated the great Osiris, either as he descended into the shade of the tomb, or as he rose triumphant out of it.

It would appear that the Egyptians, ever great in all their designs, had executed a project, the most daring which imagination could conceive, that of placing a pedestal for the sun and for the moon, or for Osiris and Isis, at mid-day for the one, and at midnight for the other, when they arrived in that part of the heavens, near which the line passes that separates the northern from the southern hemisphere, the reign of good from the reign of evil, the empire of light from the empire of darkness.

They wished that all shadow should disappear from all the faces of the pyramid at mid-day, during all the time that the sun sojourned in the enlightened hemisphere, and that the northern face should fall into shade when night recommenced his reign in our hemisphere, that is to say, at the moment when Osiris would descend into the tomb, and into hell.

The tomb of Osiris was covered with shadow during nearly six months; after which, light invested it entirely at mid-day, as soon as Osiris, having returned from hell, resumed his empire, by passing into the hemisphere of light.

Then he was restored to Isis, and to the god of spring, Orus, who had at last conquered the Genius of Darkness, and of Winter.

What a sublimity in the idea! In the centre of the pyramid is a cave, which they say is the tomb of an ancient king. That king is the husband of Isis—the famous Osiris, that beneficent king, who, the people believed, reigned long ago over Egypt, but whom the priests and philosophers knew to be that powerful star which governs the world, and enriches it with its benefits.

VE SELENIURET OF LEAD AND NATIVE SULPHURET OF SELENIUM.

rofessor Stromeyer has fa-
me with a copy of his and
or Hausmann's paper, on a
eleniuret of lead, which was
ead before the Royal Society
ingen, I beg leave to send
notice concerning it. The
was sent by M. Bauersachs
rfield in the Hartz, to Pro-
ausmann, with the obser-
that it contained selenium.
found some years since in
Lawrence mine, near Claus-
nd M. Bauersachs, who, at
e, regarded it as a distinct
termed it Cobaltic Galena,
hich name Professor Haus-
troduced it into his Miner-
The mineralogical descrip-
it, as given by Professor
ann, is as follows: Exter-
bears considerable resem-
to fine granular galena,
its colour is clearly differ-
ving a cast of blue like
ena. A crystaline texture
distinct, but, from the mi-
s of its crystals, it has hither-
impossible to ascertain their
form. Cubic and triangular
were observed; but whether
rrespond or not to those of
could not be determined.
ilar remark applies to its
es, of which there appear to
eral. It is less hard than
and its density is 7.697. It
s negatively electric from
, like galena. It is readily
osed before the blowpipe
rcoal. Besides the usual
ena arising from the pre-
f lead, the odour of decayed
adish may be perceived;
reddish-brown matter is de-
round the assay on the cool
f the charcoal. The ore
vith a clear blue light while
the blowpipe flame is playing upon it. It communicates a pale blue colour to borax, indicative of a little cobalt. When heated by means of a spirit-lamp, in a clear glass tube, closed at one end, the selenium almost instantly sublimes, forming a red ring within the tube at the open extremity of which its peculiar odour is very perceptible. On heating the tube to redness, the ore fuses, the red ring partially disappears, and is succeeded by a white crystaline deposite. This deposite reddens litmus paper, is deliquescent, and has all the properties of selenic acid. These characters, which I have myself witnessed on a specimen sent me by Professor Stromeyer, are very distinct. Nitric acid acts readily upon the ore even in the cold. The lead is first attacked, the selenium separating in substance in red flocculi; by the aid of the heat these also are oxidized, selenic acid being generated. The solution, when complete, has a pale rose colour, owing to the presence of cobalt; but the nicest test could detect neither sulphuric acid nor any other substance. The analysis was performed by the following method: After dissolving the ore completely in nitric acid, the oxide of lead was precipitated by sulphuric acid, the operation being conducted at a boiling temperature, to prevent the precipitation of any seleniate of lead. The filtered solution was then concentrated by evaporation, and selenium thrown down by sulphate of ammonia and sulphurous acid. The cobalt was next separated by the hydrosulphuret of ammonia. The proportion, as drawn from the mean of three nearly corresponding analyses, is,

Lead,	70.98
Cobalt,	0.83
Selenium,	28.11
	99.92

With respect to the atomic constitution of this ore, Professor Stromeyer remarks, that 'its constituents are combined precisely in the proportion of their equivalents, and the quantity of the selenium corresponds not only to the lead, but also to the cobalt, and that, therefore, both metals are to be regarded as in combination with selenium. The seleniate of lead, too, agrees with the sulphuret of that metal in this respect, that, when both its constituents are oxidized, the selenic acid and oxide of lead are in the precise proportion to form a neutral seleniate of lead, just as the oxidation of galena gives rise to a neutral sulphate of lead. The discovery of such a compound is therefore to be anticipated, whenever a native seleniuret of lead exists.' I take this opportunity to mention, that the native sulphuret of selenium which Professor Stromeyer detected among the volcanic products of the Lipari Isles, of which I communicated a short notice some months since, was found among a mixed sublimed mass of muriate of ammonia and sulphur. It was disposed in layers, and, from its brownish yellow colour, gives rise to the supposition that the muriate of ammonia at such parts contained iron. A superficial examination proved, however, that no iron was present, and this observation led to the detection of the selenium. In a letter which I have just received from Professor Stromeyer, he informs me that another ore has been found in the Hartz, containing the seleniurets of lead, copper, silver, and mercury, with the examination of which he is at present occupied."—*Letter from Dr. Turner, in the Edin. Phil. Jour.*

M. DUPIN'S ADDRESS TO THE MECHANICS OF PARIS,

Delivered in November last, at the Conservatoire Royal Des Arts et Metiers.

[Continued from page 383.]

I am persuaded that in employing analogous means for the industrious people of France, an improvement still greater and more rapid will result. Who can doubt the intelligence of the French artist, and his capability of promptly seizing the objects which are presented to him? In the works I have long directed, in the midst of our most active arsenals, I have had the opportunity of convincing myself of its truth.

The workmen that I have instructed, have assisted me in executing the scientific experiments upon the strength of timber, that I have made in pursuing my individual researches, or by the command of government, at Toulon, at Corfu, and at Dunkirk. These workmen perfectly comprehended the geometrical methods, and the parts of mechanics which I explained to them: they learnt to use their intellectual faculties, and very often *they perfected* the practical methods which I pointed out to them. They have contributed to the success of my experiments, as well as to that of the labours of many other engineers whom I could mention. This proves to us that the French workmen do not yield to those of any other nation in their aptitude to seize and to apply the principles of science.

The workmen that my colleagues and myself thus instructed, during the last war, were not men chosen from their infancy to give them a particular and careful apprenticeship; they were artizans furnished at hazard by conscription—house carpenters, smiths, joiners, and blacksmiths; for the most part accustomed only to the rough work of small towns, or of the country. In the evening we taught them to read and write, and in the day-time to draw vessels.

Do you know, gentlemen, the results

of these endeavours, conducted by the former scholars of the Polytechnic School?

At the time of the last war which France has sustained against England, the engineers of the marine had received from the conscription six thousand workmen, for the most part uneducated, and only capable of performing rough works. A year afterwards, thanks to the instruction we had given them, they were no longer the same men: they were equal to the execution of the greatest labours. In the single port of Anvers, they constructed an entire fleet: they had at the same time on the stocks twenty two and three decked vessels; and four years afterwards, they had at the same time twenty vessels at sea, and twenty others on the stocks to replace these.

The army had need of our services; and these same workmen constructed over the Danube, opposite to Essling and Wagram, under the fire of the enemy, bridges sufficient for the passage of an immense army. This vast labour was completed with the coolness, the mathematical precision, and the rapidity, which could only have been expected from the most able men working in perfect security, and in undisturbed leisure.

Gentlemen, what the engineers of marine have done, to instruct in the nautical arts, six thousand workmen taken by conscription from all the departments of the lowest professions, we can do with equal success for the civil arts.

We shall now survey the probable results of such a state of perfection introduced into the education of the industrious classes of society. And here we shall not only speak of what may probably occur, by means of the facilities offered to many men who have received from nature a superior genius, but likewise exhibit the salutary influence which, by means of mechanical discoveries, these men may exercise upon their country.

To change the face of a great branch of industry, to open to the commerce of a people new sources of riches and of prosperity, it has often been sufficient to perfect a single instrument, or a single machine.

Two Dutch workmen invent the telescope, and soon new heavens are discovered; the satellites belonging to the most distant planets are perceived; the system of the world is known as to its laws; means of observation are given to the navigator; and science, and the arts, and commerce, make an unexpected effort, in consequence of a former mechanical discovery. Watt improves the steam-engine, and this single improvement causes the industry of England to make an immense stride. This machine represents, at the present time, the power of three hundred thousand horses, or of two millions of men, strong and well fitted for labour, who should work day and night, without interruption and without repose, to augment the riches of a country not more than two-thirds the extent of France. A hair-dresser invents, or at least brings into action, a machine for spinning cotton: this alone gives to British industry an immense superiority. Fifty years only, after this great discovery, more than one million of the inhabitants of England are employed in those operations which depend, directly or indirectly, on the action of this machine. Lastly, England exports, for four hundred millions of francs, cotton spun and woven by an admirable system of machinery. The Indies, so long superior to Europe—the Indies inundated the west with their products, and exhausted the treasures of Europe—the Indies are conquered in their turn. The British navigator travels in quest of the cotton of India, brings it from a distance of four thousand leagues, commits it to an operation of the machine of Arkwright and of those which are attached to it, carries back their products to the east, making them again to travel four thousand leagues, and in spite of the loss of time—in spite of the enormous expense incurred by this voyage of eight thousand leagues, the cotton manufactured by the machinery of England becomes less costly than the cotton of India, spun and woven by the hand, near the field which has produced it, and sold at the nearest market. So great is the power of the progress of machinery.

Now, gentlemen, I will venture to say to those men who look upon the working classes as nothing but mere machines, I know a machine still more powerful than that of Watt—more intelligent than that of Arkwright, and capable of attaining much higher perfection. The whole world does not possess ten thousand of the machines of Watt, and twenty thousand of the machines of Arkwright. Ah well! I am acquainted with a description of machine, of which the earth possesses copies to the amount of two thousand millions. The steam-engines throughout the world do not represent a force superior to that of four hundred thousand horses, and I know one which represents by its multiplication the force of a hundred millions of horses. What, then, is this machine? Must I pronounce it, and adopt language so revolting?—It is man.

These statements alone suffice to demonstrate the material and pecuniary advantage of improving the productive and labouring faculty of the human species, even in the eyes of those proud beings who look upon the individuals of the manufacturing classes as nothing but machines or beasts of burthen.

But other considerations more vast and more noble ought to direct the statesman, ought to inspire the generous friend of humanity, and ought to influence religious minds, which see, in every rank of society, simple mortals called by the author of the universe to future destinies, eternal and sublime.

Among so many nations, so different in their character and in their possessions, whether intellectual or physical, the French nation is one of those which nature has favoured the most. Her activity has enabled her promptly to execute enterprises the most difficult and the most complicated. In all classes the understanding is extensive and rapid; the courage is ardent and enterprising, increasing by the difficulties to be surmounted, as well as by the dangers to be overcome; if we are deficient in any thing, it is, perhaps, in perseverance, particularly when success advances slowly to reward our efforts. But in this respect even, it would be exceedingly unjust to overlook and to deny the progress which our national character has made during forty years. The people in this respect, like individuals, are matured by great circumstances and great misfortunes; and of this we may be sure, that when a nation becomes illustrious, it has ceased to be frivolous.

At this day, France possesses in the intelligence of its inhabitants, as well as in the resources of its territory, every thing which can place it amongst
dustrious, enlightened, powerfu
civilized nations. But to obtai
high rank, we have occasion for
the most extended, and exerti
mind and of body distributed t
all classes of society: among
learned, to discover the means
give directions; amongst artists,
plication of abstract discoveries,
trace the new paths which in
describe.

In pursuing this career, let u
cease to remember, that we sha
constantly to contend against a
eminently industrious, active, an
severing; against a people who w
easily yield to us the victory, an
will regain from us all our adva
if we remain inactive a single i
I have already said much to y
specting this rival nation; I must
ever, say more of it still, in or
show you the nature and extent o
labours which it will compel you
dertake and to achieve. Let us
ourselves to contemplate that whic
stitutes the true power of a kin
which, in war as well as in pe
destined incessantly to contend
us: and let us especially protec
selves against that false patriotism,
would make us practise deceit
ourselves, respecting both ourselv
our antagonists.

It has been considered a gre
justice to England to declare th
achieved her victories by her tre
which subsidized a multitude of s
people, and not by the valour of h
defenders. This was at once in
confess, that gold itself is a m
force: and how had England ac
this gold? Had she procured it fr
mines? She has none which p
this metal. Had she wrung i
conquered people in her foreign
sions? This we have believed,
it we have deceived ourselves. N
India nor America has ever enrich
their tributes or their spoils, the
treasury of Great Britain. What
has been during all this time the
of this treasure?—It is the industry
people, and the labour which is its el

[To be continued.]

MISCELLANIES.

Burial Place of the Inventor of Logarithms.—The interest which we take in whatever relates to the illustrious
naturally excites a wish to know

John Napier of Merchiston,
inventor of Logarithms, were
t is said, in the account given
d writings by the Earl of
Dr. Minto, that he was in-
e Cathedral Church of St.
burgh, on the east side of its
rance, where there formerly
blet on the wall, (on the out-
hurch,) intimating that the
of the Napiers was in that
bably this has been stated on
of Maitland, who, in his
dinburgh, says the same thing,
y have supposed that the re-
s celebrated man must have
d in the family burial-place,
e be no visible memorial that
ally the case. There is rea-
, to believe that Maitland's
wrong, and that Napier was
in the Church or burying-
. Giles, but in the Church of
s, or, as it is commonly called,
urch; for, in a treatise on
, from the pen of a Scotch Ma-
James Hume of Godscroft,
pril 1635, and printed in the
r at Paris, we find the follow-
ssage: " L'inuenteur (de Lo-
oit vn Seigneur de grande con-
uel la posterite est auiourd'huy
de grandes dignitez dans le
i estant sur l'aage, et grande-
e des gouttes ne pouuoit faire
ue de s'adonner aux sciences,
nent aux Mathematiques et a
, a quoy il se plaisoit infini-
estrange peine, a construict
les Logarymes imprimees a
a l'an 1614, qui tout aussi-
t vn estonnement a tous les
ns de l'Europe, et emporteret
es (Briggs) Professeur a Ox-
erre en Escosse, pour appren-
ette admirable inuention, de
e nouuelle espece de logaryme,
e charge pour les faire apres
u'il fit comme on les voit aui-
toutes les boutiques de Lib-
urut l'an 1616. et fut enterre
e Occidentale d'Edinbourg,
de Sainct Cudbert."—No-
more distinct than this plain
facts; so that, when we con-
r the period in which Hume's
l was to the time when Na-
d that he probably had good means of knowing every thing remarkable about this illustrious man, we are led to believe that his account is correct, and that Napier was buried " without the West Port of Edinburgh, in the Church of St. Cuthbert's."

---

e was removed when the row of
e Luckenbooths was taken down;
n the church.

Philosophy.—Write filosophy or philosophy as you please, but agree that as soon as it appears it is persecuted. Dogs to whom you present an aliment for which they have no taste, bite you. You will say that I repeat myself: but we must an hundred times remind mankind, that the holy conclave condemned Galileo, and that the pedants who declared all the good citizens excommunicated who should submit to the great Henry IV. were the same who condemned the only truths which could be found in the works of Descartes. All the spaniels of the theological kennel bark at one another, and all together at De Thou, La Mothe, Le Vayer, and Bayle. What nonsense has been written by little Celtic scholars against the wise Locke! These Celts say that Cæsar, Cicero, Seneca, Pliny, and Marcus Aurelius, might be philosophers, but that philosophy is not permitted among the Celts. We answer, that it is permitted and very useful among the French; that nothing has done more good to the English; and that it is time to exterminate barbarity. You reply, that that will never come to pass. No; with the uninformed and foolish it will not; but with honest people the affair is soon concluded.—*Voltaire.*

Limits of the Human Mind.—Newton was one day asked, why he stepped forward when he was so inclined; and from what cause his arm and his hand obeyed his will? He honestly replied, that he knew nothing about the matter. But at least, said they to him, you who are so well acquainted with the gravitation of planets, will tell us why they turn one way sooner than another? Newton still avowed his ignorance.

Those who teach, that the ocean was salted for fear it should corrupt, and that the tides were created to conduct our ships into port, were a little ashamed when told that the Mediterranean has ports and no tide. Muschemdrock himself has fallen into this error.

Who has ever been able to determine precisely how a billet of wood is changed into red hot charcoal, and by what mechanism lime is heated by cold water?

The first motion of the heart in animals —is that accounted for? Has it been exactly discovered how the business of generation is arranged? Has any one divined the cause of sensation, ideas, and memory? We know no more of the essence of matter than the children who touch its superficies.

Who will instruct us in the mechanism by which the grain of corn, which we cast into the earth, disposes itself to produce a stalk surmounted with an ear; or why the sun produces an apple on one tree and a chesnut on the next to it? Many doctors have said, what know I not? Montaigne said, what know I?

Unbending decider! pedagogue in phrases! furred reasoner! thou inquirest after the limits of the human mind:—they are at the end of thy nose.—*Voltaire.*

Influence of Copper, &c. on Magnetic Needles.—M. Arago has communicated to the Academy of Sciences his further experiments relative to the oscillations of a magnetic needle surrounded by different substances. He had ascertained that the copper rings with which dipping needles are generally surrounded, exerted on the needles a very singular action, the effect of which was rapidly to diminish the amplitude of the oscillations without sensibly altering their duration. Thus, when a horizontal needle suspended in a ring of wood by a thread without tension, was moved 45° from its natural position, and left to itself, it made 145 oscillations before the amplitude was reduced to 10°. In a ring of copper, the amplitude diminished so rapidly that the same needle, removed 45° from its natural position, only oscillated 33 times before the arc was reduced to 10°. In another ring of copper, of less weight, the number of oscillations between the arcs of 45° and 10° were 66. The time of the oscillations appeared to be the same in all the rings. In the ring of wood, 145 oscillations from 45° to 10°. In the ring of copper, 33 oscillations from 45° to 10°. In a lighter copper ring, 66 oscillations from 45° to 10°.

New Metal.—A new metallic composition has lately been invented by Dr. Geitner, an able chemist in Saxony, the properties of which closely resemble those of silver. It is malleable, is not subject to rust, and is not liable to become tarnished. This composition has already been made use of in the manufacture of candlesticks, spurs, &c. and will in all probability (according to some of the foreign scientific journals) be converted into a substitute for plated goods.

New Comet.—Mr. Gambard of Marseilles, discovered a new comet on the 19th of May, though a distinct observation was not got till the 27th, at Paris. It is near Gamma, in Cassiopeia, invisible to the naked eye, without tail or apparent nucleus, having the form of nebula, which is easily distinguished, notwithstanding the light of the moon.

Permanency of Human Hair.—M. Pictet has lately made a comparison between a recent human hair and those from the head of a mummy from the Isle of Teneriffe; with respect to the constancy of those properties which render hair important as a hygrometic substance. For this purpose, hygrometers, constructed according to Saussure's principles, were made, one with a recent hair, and the other with hair from the mummy. The ancient hairs were not so strong as the other, or of sufficient length alone, but the latter objection was obviated by tying four together. The results of the experiments were, that in both instruments, the interval between extremes of moisture and the dryness of the chamber (about 25°) was passed in three minutes: that the indications, like those of the thermometer, &c. were rapid on leaving the first term, and became slower on approaching the second: that the hygrometric quality of the Guanche hair is sensibly the same as that of the recent hair.—*Bib. Univ.* xxvii. 120.

NOTICES TO CORRESPONDENTS.

Z. Z. Z., G. M., D. R., &c. &c. have been received. We should like to hear again from G. Sc. Hawick: his letter will appear next week.

ERRATA IN No. LXXXII.

Page 380, col. 2, line 24, *for* self-floating *read* self-fluting.
Page 384, col. 1, line 38, in a few copies only, *for* neutralized, *read* naturalized.

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A Committee of Civil Engineers and Practical Mechanics.

" He that enlarges his curiosity after the works of nature, demonstrably multiplies his inlets to human happiness."

No. LXXXIV. *Saturday*, 30*th July*, 1825. Price 3*d*.

MR. CARTWRIGHT'S STEAM ENGINE; PLAN FOR RAISING COAL BY A WATER-WHEEL.

Fig.1.

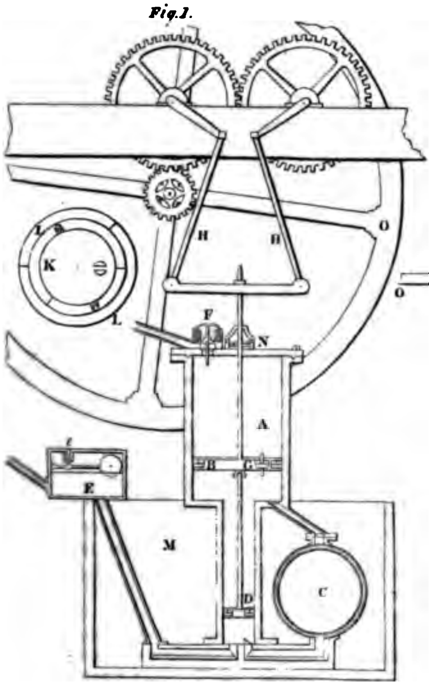


Fig.3

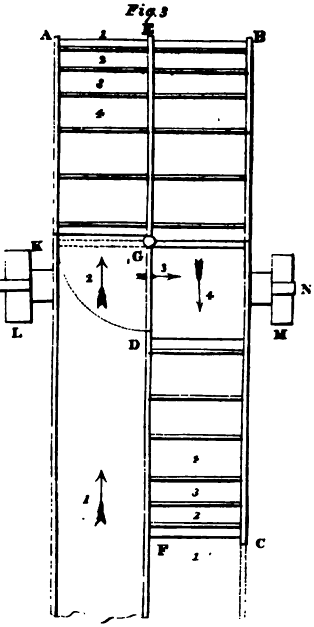


Fig 2

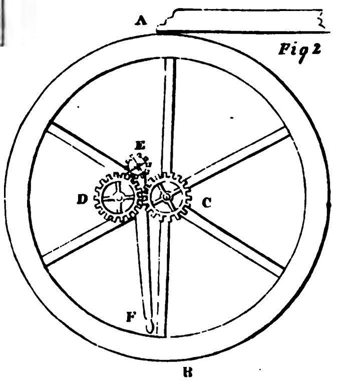
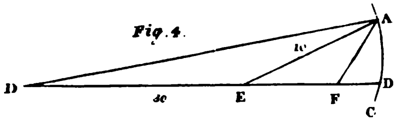


Fig.4.



SWAN Sc

MR. CARTWRIGHT'S STEAM ENGINE.

IT may, we think, prove very advantageous, when we can spare a part of our plate, to extract from some of the old volumes of the different Journals of Science to which the generality of our readers may not have ready access, a few of the improvements and inventions which are there recorded; for even where such have been found by experience not altogether to meet the sanguine views of the projectors, they may contain hints which may be of the greatest importance to intelligent mechanics. With this view we present our readers this week with an account of Mr. Cartwright's steam engine. Mr. Cartwright's first objects were to obtain, as nearly as might be, an absolute vacuum; which, in consequence of the elastic vapour that separates from water injected in the usual mode of condensation, no one in the least conversant with the philosophy of the steam engine, need be told is impossible. The condensation in Mr. Cartwright's engine is performed by the application of cold to the external surface of the vessel containing the steam. This plan had been tried by severals without success, previous to Mr. Cartwright's attempt; his plan was by admitting the steam between the metal cylinders lying one within the other, and having cold water flowing through the inner one, and inclosing the outer one. By this means a very thin body of steam is exposed to the greatest possible surface. But besides this, by means of a valve in the piston, there is a constant communication at all times between the condenser and the cylinder, either above or below the piston, so that whether it ascends or descends, the condensation is always taking place. *To reduce the friction of the piston, which, when fresh packed in the common way lays a very heavy load upon the engine, Mr. Cartwright made the packing of his solely of metal, and expansive. There is a farther advantage in this method from the saving of time and expense in the packing, and from the piston fitting more accurately, if possible, the more it is worked.* He was equally attentive in simplifying all the other parts of the engine; his engine having only two valves, and those as nearly self-acting as may be.

He had also another curious object in view in his improvements, which was to afford an opportunity of substituting ardent spirits, either wholly or in part, in place of water, for working the engine. For, as the fluid with which it is worked is made to circulate through the engine without mixture or diminution, the using alcohol, after the first supply, could be attended with little or no expense. On the contrary, the advantage would be great, probably equal to the saving of half the fuel. When, indeed, the engine was applied as he proposed, it occasionally should work both as a mechanical power and as a still, at the same time, the whole fuel would be saved.

Description of the Plate.

A, (fig. 1,) the cylinder; B, the piston; I, the pipe which conducts the steam to C, the condenser, being a double cylinder, between which the steam passes into the pump, D, that serves for returning the condensed fluid back into the boiler; E, the air-box, and *e*, its valve.

Note.—The pipe from the pump, through which the condensed fluid is returned into the boiler, passes through the air-box. What air or elastic vapour may be mixed with the fluid, rises in the box till the ball that keeps the valve shut falls and suffers it to escape.

F, the steam valve; G, the piston valve; H, H, two cranks upon whose axles are two equal wheels working in each other, for the purpose of giving a rectilinear direction to the piston-rod; M, the box that contains the condensing water; K, plan of the piston, showing the metal rings, which, by the springs L, L, are forced outwardly against the inside of the cylinder, so that the piston can adapt itself to any inequality that may arise. The piston-rod is also made steam tight in the same manner at N; O, a part of the fly-wheel which regulates the motion.

PLAN FOR RAISING COAL BY A WATER-WHEEL.

Gentlemen,—I was lately asked if I had seen any machines for raising coal turned by water, said to be in use in this country, even in this neighbourhood. I have not; but as I have few opportunities of seeing works of that kind, there may be such unknown to me. It had, however, the effect of turning my mind to the subject, and the following are a sketch of two plans I conceived, which it may be somewhat curious to compare with those already in existence, if such there be; at least I think it a little interesting to compare the ideas of different persons on the same subject, especially if ignorant of each other's designs.

A, B, (fig. 2,) is a common water wheel; A, the trough, or water-course; C, a wheel, on the same axis which turns another wheel, D, of the same size; E, is a wheel, the size of which is to be regulated by the desired velocity of the drum or axle of whatever kind, round which the ropes carrying the buckets are wound. The axle of the wheel, E, is to be so attached to that of the drum, that it may have a small lateral motion, so as to admit of being thrown alternately into connection with the wheels, C and D, by means of the lever and handle, F. It is evident that E being in connection, or gearing, as it is called, with D, (as represented in fig. 2,) will, by a pull of the handle, F, be thrown out of connection with D, and into that with C, and will consequently commence turning in the contrary direction, and so on as often as the handle, F, is moved to the one side or other, while the water-wheel is all the time turning one way. My other plan, fig. 3, is a double water-wheel, A, B, C, D, seen from above for the ease of understanding it; 1, 2, 3, 4, &c. the buckets, divided by E, F, and are on the side; A, D, the reverse of those at B, C; so that water running to the left would fill the buckets on one side, and running to the right the other; suppose the water running in the direction of the arrows, 1, 2, it will fill the part of the wheel towards A, E, turning it in the same direction with the arrows; but if by any means we turn the door, G, H, into the position, G, K, the water will instantly turn in the direction of the arrows, 3, 4, filling the part of the wheel towards C, F, and will turn it in the other direction; and so on alternately as often as the door is turned through the quadrant, H, K; L, M, are the supports of the wheel; O, N, its axle; the end, O, being attached to the axle of the drum, there will be no other machinery whatever required, except it is necessary to increase or diminish the motion of the latter. The chang of motion of the water-wheel would be attended with considerable loss of power, were its power constantly required; but as this change would take place at the same time the buckets were changing, it would be changed from a loss to a conveniency.

I have one idea farther to add, as at the greater part of coal-works there are, I believe, no falls of water fit for putting these plans in practice. Perhaps in many instances the water pumped by the engine might be adequate to the purpose: raising the water a few feet higher would be nothing to the engine; and thus the raising of coal would be carried on at no expense, except the first cost of a water-wheel and course.

I am, yours, &c.

G. M.

Glasgow, 14th July, 1825.

ON THE REFLECTION OF LIGHT.

The leading opinions among the moderns with regard to the nature of light, are the two supported by Newton and Descartes, which it may not be improper briefly to state before considering our direct subject.

According to the former of these two philosophers, this subtle agent consists of an indefinite number of exceedingly small particles thrown off in all directions from the luminous body; while, according to the latter, it is occasioned by the pressure of a fluid, every where and at all times present, and which only requires to be set in motion by a luminous body. Rays of light are accounted for by these hypotheses also, in different ways, in so far as in the one case they are supposed to be a succession of moleculæ, which are moved by slight oscillations repeatedly continued; and in the other, which are all thought to have an impulsive force, and to succeed one another in an uninterrupted course.

Although objections have been started against the hypothesis of Newton, they are of such a nature as not to invalidate the justice of its claims to be considered as the preferable hypothesis on this subject, over that of Descartes; if we adopt which, says an able writer on this subject, "we must cause ourselves to believe that there is no such thing as night; and that in total eclipses of the sun, no such thing as complete darkness ever occurs."

One of the principal properties of light, and one which all observation of its nature readily points out, is the reflection of light; which, with the various phenomena depending on it, is treated of in that branch of Optics which has been denominated Catoptrics. By this reflection of light is meant the change of direction which it experiences, when it is repelled or reflected from the surfaces of transparent or opaque bodies.

The common opinion entertained of the cause of this reflection was, that it was occasioned by impinging upon the solid parts of a reflecting surface. But Sir Isaac Newton has exhibited the improbability of this being a true opinion; and contends, that on this supposition the reflection of the most polished surface must be very irregular; and indeed that the light would be scattered as much by the most polished as by the roughest glass. He concluded that the regular reflection of light was owing to some power of the body evenly diffused all over its surface, by which it acts upon the rays without immediate contact.

The reflection must in every case be occasioned by the resistance of a substance opposing the admission of the light, which, if it could be removed, would cause the surfaces no longer to reflect.

The general law on this subject, that the angle of reflection is equal to the angle of incidence, (that is, to the angle which the incident ray contains with the perpendicular, to the reflecting surface at the point of incidence,) holds in the case of all reflections, whether from plain or curved surfaces. This law is very obvious, and leads to the explanation of several terms which are in common use in the science of Optics.

By a radiant point is meant a point from which light is emitted, and whence rays proceed, which, when they show a disposition to be turned back into the medium from whence they came, are said to be reflexible; the change of motion which the ray in this case undergoes is called its reflection.

The incident and reflected rays at the point of incidence, contain, with the perpendicular to the reflecting surface, angles which are called angles of incidence and of reflection.

The focus is a point from which rays diverge, or towards which they converge. In the former case, the focus is imaginary, and is called the virtual focus; the other is called the principal focus. Before reflection it is called the focus of incident rays; after reflection, the focus of reflected rays; and these two stand in relation to one another in such a way that if either of them be the radiant point, or the focus of incident rays, the other will be the focus of reflected rays.

Aberration in optics is that deviation of the rays of light, when inflected by a speculum, whereby they are prevented from meeting in the focus. As rays can be converged accurately to positive foci only by mirrors of a paraboloidal, ellipsoidal, and hyperboloidal form, and as polished metals cannot always be made to assume these forms, it becomes a matter of importance to determine the amount of the aberration when they have a spherical form; this we have endeavoured to do in the following problem:—

Let the radius of sphericity, E, B, in a concave reflector $= 10$ inches, the distance of the radiant, D, B, $= 40$ inches, and the arc of reflection, A, C, $= 1^{\circ}$, or A, B, $= \frac{1}{2}^{\circ}$; required the point F, where the two rays meet.

$$\text{Given } E\,B = E\,A = 10,\ D\,B = 40 \therefore D\,E = 30,$$

$$\text{angle } A\,E\,B = \tfrac{1}{2}^{\circ} = 30' \therefore A\,D\,E + E'\,A\,D = 30' \text{ to find } F\,B.$$

As $(D\,E + E\,A) : (D\,E - E\,A) :: \tan.\ \frac{1}{2}\,(E\,A\,D + A\,D\,E' : \tan.\ \frac{1}{2}\,(E\,A\,D - A\,D\,E) \therefore 40 : 20 :: \tan.\ 15' : \tan.\ 7\frac{1}{2}$, because the tangents of small angles are very nearly as these angles; hence,

$$15' + 7\tfrac{1}{2}' = 22\tfrac{1}{2}' = D\,A\,E = E\,A\,F.$$

$$\text{Now, angle } A\,F\,B = E\,A\,F + A\,E\,F = 22\tfrac{1}{2}' + 30' = 52\tfrac{1}{2}'$$

$$\text{and } \sin.\ A\,F\,E = \sin.\ A\,F\,B = \sin.\ 52\tfrac{1}{2}.$$

$$\text{But, } \sin.\ E\,F\,A : \sin.\ E\,A\,F :: A\,E : E\,F$$

$\sin.\ 52\frac{1}{2} : \sin.\ 22\frac{1}{2} :: 10 : 4\frac{2}{7}$, if the angles be taken as the sines; but if not, then

$152660 : 65399 :: 10 : 4.28396 = E\,F$, which differs from the former value only by .00175;

$$\text{whence } F\,B = 10 - 4\tfrac{2}{7} = 5\tfrac{5}{7} \text{ or } 10 - 4.28396 = 5.71604.$$

Now, by the formula, $F\,B = f = \frac{d\,r}{2\,d - 2} = \frac{40 \times 10}{80 - 10} = \frac{400}{70}$ $= 5\tfrac{5}{7}$;

whence the difference between the distance of the point of meeting of the two rays, when the angle of reflection is 1^0, and when it is infinitely small, is only

$$5.71604 - 5.71428 = .00176 = \tfrac{1}{569} \text{ of an inch nearly.}$$

Z. Z. Z.

STIRLING SCHOOL OF ARTS.

At a meeting held at Stirling, on Tuesday the 12th current, a School of Arts was established for the instruction of the mechanics and others of that city and neighbourhood; and we are most happy to say, that, from the liberal manner in which a number of the wealthier inhabitants have shown their desire to patronize it, and from the spirit manifested by the artizans for whom it is more immediately intended, there seems little reason to fear with regard to its success. A library is immediately to be formed; and a series of six lectures on different branches of Natural Philosophy, illustrated by experiments, are to be delivered by Mr. M'Come, lecturer to the Paisley Institution. The principles on which the Institution is founded seem to be very liberal. The affairs are to be managed by a committee of fifteen directors, ten of whom are to be tradesmen, and the rest chosen from among the other members of the Institution. Four shillings annually constitutes a member; and three guineas, one for life,—both giving a right to the use of the library. An additional sum is to be charged for admission to the lectures; and it is to be left optional to the members whether they pay this and attend the lectures or not. This we think an excellent plan; and indeed one strong objection to all the mechanics' institutions hitherto formed has been, that persons were prevented from obtaining the use of the books, without they paid for attending the lectures. Now it is perfectly obvious, that many may wish to enjoy the temperate luxury of reading, without attending the lectures, which they may previously have attended more than once.

Stirling has been long notorious for the party spirit of its inhabitants, and the violence of its burgh politics, we would probably not have augured well of any attempt to originate a School of Arts there; but we are glad to find that the attempt has not only been made but has succeeeded. We observe that the chief magistrate of the city, and one of its clergymen, are the president and vice-president of the Institution. This speaks well; and shows that in the great cause of education, all classes of the community are ready to join heart and hand.

We are sorry our limits will not allow us to give the whole of the chaste and eloquent address delivered to the meeting by the Rev. Mr. Bennie; but the extracts which we have given, sufficiently show that this gentleman is as much to be admired for his liberal and extensive philanthropy, as he is for his brilliant talents, and his overwhelming powers of eloquence.

"It is certainly one of the most pleasing facts in the history of this age, that so many institutions should have been formed for the express purpose of instructing and enlightening the poor. When we reflect, indeed, on the inestimable benefits which such institutions are the means of diffusing, we cannot but be surprised that so much time should have elapsed before they were commenced: as for ages men have been busy acquiring knowledge, multiplying the resources of the mind, and enlarging the sphere of its views; and experience has long since shown how much knowledge contributes both to the dignity and happiness of our nature. In this country, in particular, where science has advanced with a vigour and rapidity that astonished the world, we might have expected that at a much earlier period, means would have been devised for communicating its treasures to the humble poor. For the most part, however, it has been confined to the learned and the rich. It has been invested with a sort of aristocratic dignity, and has seldom come forth from the retirement of the studious to meet the gaze of men. Occasionally, indeed, individuals from the humblest ranks, have burst through the obscurity of their condition, and by splendid genius, aided by habits of intense application, have reached the height of fame. The names of Watt and Davy, for instance, in our own time, have been associated with the proudest inventions of science. But, in general, the working classes have shared little in the benefits of science. To them its deep fountains have been sealed, and its pure pleasures denied; and with souls capable of high improvement, and in some instances endowed with admirable and brilliant gifts, they have been allowed to toil in the drudgery of their humble arts, unaided by the lights of philosophy, and uncheered by its rewards. A better spirit has at length gone forth. A warmer feeling of sympathy in the condition of the working classes has been excited; and, already, science, no longer confined to colleges and halls, walks abroad into society, and may be found in the workshops and cottages of the poor. I rejoice in this state of things. I feel gratified beyond measure by the prospects which are thus opened up; for I am convinced that by instructing the poor in the principles of science, you call *forth energies* that might otherwise have been deadened; you furnish views which both elevate the mind and purify the moral taste; you supply an antidote to some debasing vices, and diminish the influence of temptation; you give to obscure talent, opportunity; to ardent genius, encouragement; you lead them to sources of enjoyment, the most satisfactory and the most permanent;—in short, you make the poor better and happier men. I speak from sympathy in the condition of the poor. I know how much talent and ingenuity are often concealed under the obscurity of their lot; and I have no doubt that by opening to them the temple of science, you will not only awaken them to a deeper sense of the dignity and functions of their nature, but you will strengthen and hallow the bonds of social security, whilst you will probably call forth an array of talent in the humblest ranks, which may contribute largely to the instruction and delight of future generations."

"For a long period there was scarcely any connection between science and the arts; they were two distinct regions—opposite hemispheres, the one for the speculations of the mind, the other for the operations of the hand; but in these latter days they have been completely united: the arts have been indebted to science for some of their noblest improvements, while science derives its most brilliant illustrations from the arts. I cannot help pressing particularly on your notice, the advantages of such institutions to the labouring classes, as they may enable them to exercise reflection in their ordinary pursuits. Whatever calls forth the energies of the mind, rouses it to inquire, and expands its views, must be desirable; for as the mind is the nobler part of man, whatever invigorates and improves it, must refine and increase his happiness. In whatever condition we are placed, the more active the mind, the more abundant its pleasures. I say then, if you can enable the mechanic to enter his workshop, with a mind desirous to be informed, accustomed to reflection, and familiar with the great facts of science, you confer an unspeakable benefit. Instead of the dull, plodding, listless artist, who is scarcely more interested than the tools he works with, you will have an active, intelligent, industrious being, conscious in some measure of the high dignity of his nature, contemplating with a patient and admiring eye, the mysteries of the universe; and perhaps glowing with the buoyant ardour of unextinguishable genius and power. I would not anticipate too much, but such effects may be produced. I see no reason why they should not be produced. Men seem only beginning to be conscious of the vast resources which lie hid in their nature; and surely the meanest and the poorest, with reason as their prerogative, and immortality as their destiny, may thus be elevated in the scale of being, and permitted to enjoy, amidst all their privations and obscurity, the pure and satisfying pleasures of cultivated minds. There is a voice now sounding through this land in the ears of the labouring poor, 'Enter the temple of Science, and enrich yourself with her splendid treasures;' and I have no doubt that future generations will often recal with gratitude and delight, the origin of institutions productive of so much happiness, prosperity, and virtue."

"I am aware some people think that the information communicated on the general principles of science may lead the working classes into habits of inquiry incompatible with the rigid performance of those humble tasks in which they are daily employed. But this objection is founded on a wrong view of the objects which this institution embraces. We do not propose to open up to mechanics the wide fields of literature, nor even those branches of science which bear no relation to the arts of life. It is mechanical philosophy we wish, in the first instance, to familiarize to their minds; and so far from rendering them indifferent to the arts in which they labour, the information communicated will awaken and cherish a deeper interest in these arts, and a more anxious desire to polish and improve them. But, indeed, I do not like the spirit in which this objection originates. It betrays a mean jealousy of the working classes which I cannot tolerate; and I cannot help considering it as allied to that base contemptible spirit which would lead some to refuse all liberal instruction to the poor, and to secure their subordination by obstructing their improvement. Let the mechanic be instructed; let him acquire a relish for intellectual pleasure; let him invigorate his mind by the speculations of science; you have nothing to fear—for *knowledge* matures the judgment, polishes *the character*, and refines the heart.

"Akin to this objection are some of those suspicions which have been thrown out against the dissemination of science among the poor, as likely to foster a spirit of irreligion. I think these suspicions should be treated with contempt. I consider them as unfounded; illiberal in the extreme. I am persuaded, the tendency of scientific knowledge is the very reverse of this. I do not hesitate to affirm, that such institutions as that we now propose, will have a very powerful effect in arming the minds of the young against the seductions of unholy speculations, and in inspiring a reverence for those sublime truths which are accompanied by evidence the most clear and incontrovertible. There is much scepticism and unbelief in society; but what is the cause of this? It is because men will not inquire and examine with candour. By instructing mechanics in the principles of science, you will discipline their minds for inquiry; you will dispose them to weigh well before they doubt, and to reject established truths with caution; and you will give them a sedate sobriety of thought, the very opposite of that reckless spirit of speculation to which infidelity may generally be ascribed. Science, besides, unveils a world of wonders at every step. It fills the universe with an amazing splendour, which elevates the mind; and the very difficulties which it cannot surmount, only deepen that awe which the magnificent works of the Creator inspire. Men of great science, no doubt, have sometimes been the enemies of religion; but this is not generally the case, though the pride of intellect, and other causes, may have tempted a few to err. But the truth is, science is a commentary on natural religion, and natural religion is the ally of revealed. Just think of an ignorant mind meditating on the mighty frame of the universe—how dull its conceptions, how grovelling its views—how cold its sentiments; but give that mind knowledge, open up to it those admirable discoveries which science claims as her own, and its conceptions brighten, its views expand, and its sentiments kindle into glowing fervour.—In short, I anticipate the happiest result from the diffusion of science; results the most beneficial to individuals as well as to society. Many ignorant minds will be enlightened, and stimulated to reflection; habits of intellectual activity and sober industry will be confirmed; and a taste for the pleasures of knowledge will be gradually imbibed. I cannot but anticipate with delight the emancipation of so many of my fellow-creatures from prejudice and sloth. For surely nothing can be more painful to a contemplative mind, than to think there should be such multitudes, with minds capable of improvement, but deadened by indolence—imprisoned, as it were, amidst darkness and error; and without any of those noble conceptions, those bright glimpses of truth, which both elevate and soothe the mind. Let us trust the spell is now broken; the prisoners are set free; the triumphant march of intellect has begun; and as it advances, it will disclose a brighter lustre, and a more gigantic energy."

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ON GRAFTING FRUIT TREES.

2.—*Cleft Grafting.*

I now proceed to describe the second method of grafting fruit trees, *viz.*—Cleft Grafting.

This method is resorted to when the stock is too large to admit that already described. *See Whip Grafting.*

The size of the stock, however, must not exceed that of the graft beyond a determinate limit; for if the rind of the stock be too thick, the inner bark of the stock and scion will be prevented from uniting. The stock is usually from one inch to three in diameter.

Begin the operation by smoothing with a knife the top of the stock where it has been headed. Then, marking about one-fourth in diameter of this top to be left horizontal, cut from the mark to the opposite side of the stock in a sloping direction: next, hold the edge of a strong knife on the top in a right angle with the slope; and with your mallet make a cleft, deep enough to receive the scion, and keep it open with a wedge. To prepare the scion for insertion; first, cut the bottom of it with a double slope, like a wedge. Secondly, slope the bottom of the wedge so as to leave a broad portion on one side of the graft, with the rind entire; this side is to stand outwards. Insert the scion into the cleft of the stock, on that side of the stock which is not sloped, so as to make the rind of the one join that of the other exactly; for without their perfect connection, the graft will not succeed. On removing the wedge, bind them together with bass strings of woollen yarn, to prevent the cleft of the stock from opening. After which, protect the joint from the air by a coat of composition, beginning from the bottom as far as the cleft extends, and carrying it up the graft a competent height. The scion may be six or eight inches long. Two eyes at least should be left uncovered for shooting. Two grafts may be inserted into one stock; in which case the stock must be large enough to admit of two parallel clefts.

C. D.

Woodside, 20th July, 1825.

To preserve Gooseberries long in season.

CHOOSE a well loaded bush, the fruit nearly ripe, cover it from sun, air, and wetness, either by staking it round, and winding round the stakes with ropes of hay or straw, or covering it with an old stone-ware, or glass-ware crate, surrounded with bass or pack-sheeting. If properly done, the fruit may thus be preserved in good order, until frost comes on so severe as to injure it under any circumstance.

A. W.

Paisley, 21st July, 1825.

Statement of Claims to the Invention of the Process for Discharging Turkey-Red. By Mr. John Miller.

Gentlemen,—I send you a number of letters, in order to prove the assertions of those who have written in your Magazine against me, regarding the discharging of Turkey-Red cloth, unjust and unfounded.

These letters are all from mechanics who wrought at the presses which I invented for the above purpose, and made from the commencement. I wish, when convenient, to show in your Publisher's shop, twelve different patterns which were the first that ever had distinct boundaries formed by the discharging liquor; their different figures were made with lead and brass bandages. The present construction of the cast-metal press is the same as the construction of those I made at first; and I always used Messrs. Tennant, Knox, & Co.'s bleaching salt, a process which was first introduced by me. I had their authority for this statement nearly thirty years ago, and have to this day; and that liquor is now generally used for the same purpose.

All the trials which had been made in discharging before my invention, were made with Berthollet's common bleaching liquor, which every bleacher in the country knew very well between thirty and forty years ago; and there was not a bleacher at that time who was unacquainted with the common method of discharging turkey-red and other colours, *viz.* by dipping their finger into the common bleaching liquor and then sprinkling it on the dark turkey-red pullicates. Mr. Campbell's and others' attempts, indeed, were no better than this simple process, for he had no bandages, nor even a press of the construction that I invented, which construction is used to this day. If the company who employed Mr. Campbell and his assistants, had sent them a common broom, with instructions to dip it in the common bleaching liquor, and shake it above the cloth, it would have produced better work than what they produced. Mr. Campbell showed his ignorance in saying that he used tin; for the liquor destroys tin, and the lead which is used, ought to be of the purest kind, and free from any mixture. After all their trials, therefore, the company had to give up the attempt at discharging on his plan, and try Mr. Campbell with one of my presses, made by Mr. Roberton; but such was his ignorance of my plan, that he could not work the press after it was set up to him; and Messrs. M'Brain, Stenhouse, & Co. continued to do the company's work in the discharging line, from the year 1805 till the year 1811,—that is, till as many of my presses were set a-going at Barrowfield as did their whole work. In proof of this I may state, that, after Mr. C.'s unsuccessful attempts, Mr. George Rodger was sent down from Blantyre to the warehouse in Glasgow in the year 1805; and Colin M'Callum was put to the warping with a William Ross, and John Strathern to the starching, and all farther attempts were given up for a time. Indeed, Mr. Campbell and others have said that they did things which they durst not do at that period, and which the company in whose employ they were, would not allow them to engage in; for before any person can print or discharge cloth, he must make an entry at the Excise Office of the place where he intends to begin; then he must take out a licence, for which he must pay twenty pounds, and before he can print or discharge, the officer must measure every piece, and put the length and breadth on each end of it; and even after they are finished, they cannot be sent off before the officer puts the king's stamp upon them. In this statement of facts, it must therefore be evident that your Correspondents are mere boasters, and ought not to be esteemed inventors. I beg leave now to submit my proof, which I hope you will publish.

I am, GENTLEMEN,
Your obedient servant,
JOHN MILLER.

List of Presses.

	Presses.	Patterns.
In the year 1804, Messrs. John & James Roberton made the first Large Press, and in all,...	10 ...	13
In the year 1805, Mr. William Rentoul made one Furniture Press and Pattern, ...	1 ...	1
In the year 1805, Messrs. M'Brain, Stenhouse, & Co. commenced to make their Press and Pattern, and in all, ...	6 ...	6
In the year 1805, Mr. John Paton made his first Press, and in all,	17 ...	23
In the years 1809 and 1810, Mr. Alexander Guthrie made, ...	6 ...	6
In the year 1805, Mr. Walter Weir made,..............................	1 ...	1
In the year 1812, Mr. Girdwood made, ...	2 ...	2
In the year 1812, Mr. Currie made,..	2 ...	2
In the year 1809, Mr. John Wotherspoon made, ...	1 ...	1
In the year 1809 or 1810, Mr. Inglis made, ...	2 ...	2
In the year 1810, Mr. Monteith at Barrowfield had five Presses, the Patterns and other articles were made by Mr. Dunn, ...	5 ...	5
Total,..........................	53 ...	62

The whole of these were mounted with cast metal presses, with lead and brass bandages to form the figures, in the same manner in which they are made at the present day.

No. I.

Tradeston, Glasgow, 30th Dec. 1824.

Mr. JOHN MILLER,

SIR,—I was in the employment of Messrs. John & James Roberton when they mounted your first large Press. I assisted in putting up several of them at Rutherglen Dye Works and other places; and I beg to state that all their Presses gave complete satisfaction at the period of their erection.

Mr. Rodger and Mr. M'Callum came down from Blantyre and treated me often, for the purpose of getting information how you mounted your Presses, but they never got any which was satisfactory on that point from me. In 1805, Mr. Monteith ordered Mr. Roberton to make a full mounted Press and Pattern, which was set up at Blantyre, but his men could not work it; Mr. Roberton, therefore, took it off their hands for a sum of money, and it was afterwards sent to Messrs. Thomson & Fraser, Parkholm. Alex. Robertson and I set it up there, and afterwards it gave complete satisfaction.

I am, SIR, your obedient servant,
JOHN TAYLOR.

No. II.

Crossmill, 14th Jan. 1825.

Mr. JOHN MILLER,

SIR,—As to the discharging business carried on at Crossmill Printfield, I remember in the year 1804 you came out to Crossmill, and brought a pattern of cast-iron with you about 34 inches square, and $1\frac{1}{4}$ inch thick, with an edge about an inch deep on the one side, the other side was set with types of brass about $\frac{5}{8}$ of an inch long, which were for discharging Turkey-Red cloth. In the beginning of the year 1805, we began to make one on the same construction as the one you showed us, except that the types were set to a different pattern. We also got a Press made, and every thing answered our most sanguine expectations: we got other three Presses made, and with these four Presses we discharged cloth for Messrs. Henry Monteith, Bogle, & Co. till the year 1811. The discharging liquor was made from Messrs. Charles Tennant & Co.'s bleaching salt, which you introduced. We were the first that began the discharging with your Presses, after you invented them, and we did the greatest quantity of work in that line for several years. I have now wrought and superintended copperplate printing presses between fifty and sixty years, and I have no hesitation in saying, that the discharging presses wrought as easy as the copperplate presses, and made as distinct impressions, and that your presses were the first that brought the discharging of Turkey-Red to be a trade. It is unjust in your opponents to say that the types hurt the cloth in the discharging; we were never found fault with on that account, for we always made the types of such a thickness that they could not hurt the cloth. About the year 1817, we made two lead patterns, not because the lead made better work than the brass types, but that a greater variety of patterns were got at a less expense; the lead patterns had, however, more surface than the type patterns, and, consequently, required a greater pressure. We also made two presses of greater strength than the old ones, but they were on the same principle; the lead is put on the cast-metal plate in the same manner as the brass, and works in the same way.

You neither took out a patent for the construction of these presses, which are in use to this day, nor for the liquor that you introduced. You invented the lead bandages first, and then the brass ones in 1802 and 1803. I have in my possession copies of both the lead and brass bandages, and you have still the original presses in yours.

As to the plan mentioned in Mr. David Campbell's statement in the Glasgow Mechanics' Magazine, it was only an experiment which could not possibly succeed, nor was there ever such a thing known in the trade as what he describes; on the contrary, it is well known to those who are in that trade, that there is not a thing of the kind employed except your presses, and this liquor which you introduced.

I am, Sir,
Your obedient servant,
John Moffat.

No. III.

Tradeston, 3d May, 1825.

Mr. John Miller,

Sir,—I was with Mr. Roberton in 1804, when he mounted your first large presses, and I was afterwards employed in mounting several of them at *Rutherglen* Dye Works and other places. In 1805 I agreed to superintend Mr. Goudie's machinery, and wrought occasionally at the discharging presses. In the same year I mounted a furniture pattern, which was denominated a running pattern, and was black, red, and white. This was the first furniture pattern that brought the discharging process to be a trade. You have two copies of those patterns which were done at that time, and I have two copies likewise. I have put my initials upon them, as I understand that you mean to show them in the shop of the Publisher of the Glasgow Mechanics' Magazine. All these presses were mounted with cast-iron, lead, and brass bandages, to form the figures as they are used at this day. All the attempts that were made before yours failed; and your presses were the first which, as I have said before, brought the discharging of Turkey-Red to be a trade. I am surprised to see in the Edinburgh Encyclopedia the invention of your presses, which are there exhibited, ascribed to persons who have no right to them. I am likewise surprised to see in No. II. of the Glasgow Mechanics' Magazine, the press that I mounted to you for doing running patterns, when those very people who claim the merit of them did not commence the business for many years after you invented them and brought them into practice. It is not you alone whom they have tried to rob of the merit, but they have tried to rob the deceased Mr. John Roberton, engineer, for they have exhibited the very presses that he mounted for you in the Edinburgh Encyclopedia, and have never mentioned his name. That these presses were mounted by him, many of his old servants can attest beside me; and we can also attest they were the first presses that ever were made with cast-metal and bandages to form the figures. It is very strange that those persons now pretend to claim the invention, who were so ignorant of it at that time, that as soon as they heard that Mr. Roberton was mounting your presses, they came down from Blantyre and treated Mr. Roberton's men with drink, in order to get information how they were mounted. Mr. Roberton mounted your first large press from the model of your small press, which was mounted with lead bandages, and is still in your possession. You likewise introduced the brass bandages for the open patterns, which did safe and distinct work, and the press was easily wrought, and these open patterns were in demand for ten or twelve years. I have mounted and repaired them many a time since, and there is no alteration upon them, but they all work in the same way as you made them at first.

As to Mr. Campbell's proof, it is no proof at all; there was never such a thing in the trade as a plain piece of tin and lead fastened to a piece of wood employed for discharging; for it was only an experiment of his own, which never did nor could succeed. It was very unjust in Mr. Campbell to say that the brass bandages hurt the cloth; this, indeed, showed his ignorance of the business, for brass bandages might be made as broad as lead ones. But you were not answerable for ignorant people, who might work the presses wrong, and make up the liquor wrong, by using too much vitriol.

I remain, SIR,
Your obedient servant,
WM. RENTOUL.

No. IV.

Tradeston, 9th May, 1825.

Mr. JOHN MILLER,

SIR,—All the attempts that were made for discharging failed till you invented your presses in 1802 and 1803, with lead and brass bandages. This invention was the first that set boundaries for the formation of different figures by the discharging liquor, and it is in use to this day.

I am, SIR,
Your obedient servant,
ROBERT JAFFREY.

No. V.

Tradeston, 9th May, 1825.

Mr. JOHN MILLER,

SIR,—I wrought with you when you commenced the discharging at Mr. Goudie's Dye Work. We had three presses for doing bandannas; they were made by Messrs. John & James Roberton, and they were all mounted with cast-metal, and lead, and brass bandages, with various patterns; they were made the same as your small press, which you made in the year 1802 and 1803, which had lead bandages, and is still in your possession. These were the first presses and patterns that brought the discharging process to be a trade, as it *continues to be at this* day. Mr. Thos. M'Kay and myself discharged betwixt 80 and 100 pieces per day, every piece containing twelve and sometimes thirteen handkerchiefs. We likewise had two furniture patterns; you have copies both of the furniture and handkerchief patterns which were done at that time. We always used Messrs. Tennant, Knox, & Co.'s bleaching salt, which you introduced, and the whole of these presses gave complete satisfaction, for I have wrought them many years; the furniture pattern was mounted by Wm. Rentoul.

As to Mr. David Campbell's proof, it really is not worth your while to reply to it, being childish in the extreme; for his attempt was as bad as he said Mr. George Rodger's was, which was made with plain mahogany boards. George Strathern, his only witness, says that his plates were only composed of plain tin and lead fastened to a wooden plate; such being the case, it was not to be wondered at that the company turned them off, as they never could produce accurate work. Messrs. M'Brain, Stenhouse, & Co. continued to discharge the company's goods after that for nearly six years. And to prove their ignorance, I may mention that Mr. Monteith tried them a second time with one of your presses, made by Mr. John Roberton, but they could not work it, so that it was given up and they were disbanded; and indeed they cannot deny that Mr. George Rodger was sent down to the warehouse in Glasgow, and Colin M'Callum put to the warping with William Ross at Blantyre, John Strathern to the starching, and George Strathern to some other employment. When they began at Barrowfield, a good number of years afterwards, they did not begin with plain mahogany boards, nor a plain tin plate nailed to a piece of wood; no! it was with your presses that they began, and it was Mr. John Paton who made the first set of patterns for them of cast-metal with brass bandages, and Mr. Dunn made four or five sets of patterns, all of which wrought the very same way as the one Mr. Roberton made for you at first.

Mr. Campbell says that Mr. Monteith parted with nothing but his brass bandages; but he could part with nothing of his, for he had nothing of his to part with; he, however, took your brass bandages and cast-metal plates, and then your lead bandages with cast-metal plates and frames, and as to these bandages they may be made thick or thin.

As you mean to show in the Publisher's shop that the patterns were done at that time, I have put my initials to them, as they were the first that ever were done on the large scale, to show that the assertions of Mr. David Campbell and others against you are unjust.

I am, Sir,
Your obedient servant,
Robert Jaffrey.

No. VI.

Glasgow, 17th May, 1825.

Mr. John Miller,

Sir,—I am surprised to see Mr. David Campbell's account of discharging Turkey-Red bandannas in the Glasgow Mechanics' Magazine, by a process that never could succeed, (notwithstanding his evidence,) with plain plates composed of tin and lead fastened to a piece of wood.

Your presses with cast-metal, lead plates, and lead and brass bandages were the first that brought the discharging to be a trade. You invented them in 1802 and 1803, and they all went with four guides and a single screw, and the system is not altered to this day, though they may work them with Bramah's press. I wrought with Mr. John Paton for a considerable time at mounting the discharging presses and patterns for different companies. About the beginning of the year 1809, Mr. Paton made one set of plates of cast metal, with brass bandages for Mr. Monteith, when he commenced at Barrowfield.

In the years 1809 and 1810, I mounted six discharging presses for a company on my own account, and they were all mounted with cast-metal plates, and lead plates, with brass bandages to form the figures. They all wrought the same way as the one Mr. Roberton made for you at first, and as they do to this day. Although I had mounted the presses which I made with gold or platina bandages instead of lead or brass ones, this would never have altered your system. The lead bandages were the first that you discharged with, which are still in your possession, for I have seen the original model both of lead and brass bandages, and patterns struck off from them within these few days. All these presses did as safe and distinct work as any copperplate press did, for I have wrought and superintended the copperplate presses for several years.

I am, Sir,
Your obedient servant,
Alex. Guthrie.

N. B. There was never such a thing in Mr. Monteith's work at Barrowfield as a plain tin plate fastened to a piece of wood; he first had your cast-metal plate with brass bandages, and then your cast-metal plate with lead bandages and cast-metal frames, which continue to this day.

A. G.

No. VII.

Glasgow, 26th May, 1825.

Mr. John Miller,

Sir,—The two Turkey-Red discharged furniture patterns which were shown me, and on which I have put my initials, were drawn by me agreeably to your order in the summer of 1805, being the first of the kind ever introduced to the market.

I am, Sir,
Your obedient servant,
William Keith.

EVOLUTION OF CARBONIC ACID GAS AT THE LAKE OF LAACH, AND IN THE VOLCANIC DISTRICT OF THE EIFEL.

The occurrence of spring waters, impregnated with carbonic acid, is not very uncommon, but the permanent evolution of this gas, from the fissures of rocks, is less frequent. Bischof and Noggerath, in *Schweigger's* Journal, mention a pit, on the side of the lake of Laach, in which they found many dead animals, as birds of different kinds, squirrels, bats, frogs, toads, and also insects. On descending into the pit, and gradually sinking the head, they experienced the same sensation as when held over a vat in a state of fermentation. The quantity of evolved gas varies at different times. This evolution of carbonic acid gas is more striking in the volcanic Eifel. On the right bank of the river Kyll, nearly opposite to Birresborn, there is a spring named Brudelreis, a provincial name for a boiling spring, and applied to this because its surface is perpetually agitated by large air-bubbles. The agitation occasioned by the evolution of the gas is so great, that the noise is heard at the distance of 400 yards. In the vicinity of the basin of the spring, numerous dead birds are found, evidently killed by the carbonic acid which rises from the surface of the water. Persons who kneel down to drink out of the spring, are driven back by the emphitic exhalation from the water. Five hours from Triers, in the neighbourhood of Hetzerath, there is another spring, which resembles that just mentioned, in forming a a basin, giving out much carbonic acid, and emiting a loud noise. Bischof and Noggerath visited the Brudelreis: they heard the noise occasioned by the evolution of the gas at a considerable distance; and found, on approaching their faces to the surface of the turf in the vicinity of the springs, that it was covered with a layer of carbonic acid. They did not observe that the carbonic acid produced any deleterious effects on the surrounding trees or grass, although it is known that the moffettes of Vesuvius exert a destroying effect on the roots of the plants of that district. On emptying the basin, no more water was collected, showing that it was rain, not spring water; but the carbonic acid continued to rise through the fissures of the rocks, and through some with so much power as to feel to the hand like the wind from the nosle of a bellows. On pouring a glass of lime water into one of the fissures, it became turbid, and the phenomenon of ebullition, although on a small scale, was thereby exhibited; but they did not ascertain if the gas was perfectly pure carbonic acid. Carbonic acid is evolved in considerable abundance, as well from volcanoes in a state of activity as from those which are extinct. These exhalations may be divided into *transitory* and *permanent*. The first are the most common moffettes, such as those evolved from Vesuvius, and its vicinity, after every eruption. They appear frequently a month after the eruption, are exhaled in great quantity, and act deleteriously on animals and vegetables, but at length entirely disappear. The *permanent* moffettes, again, are known to have continued for ages, as is the case in the Grotto del Cane, near Vesuvius. Similar permanent exhalations occur in other quarters. In the great stream of lava, which extends from Clermont to Royat in Auvergne, there are many caves and caverns, of which the most celebrated are the caves of Montjoly. In many of these the same phenomena occur as in the Grotto del Cane at Naples. Similar caves occur in volcanic hills in the Vivarais; but it is probable that the irrespirable gasses which occur in the caves of Ribar, near Newsohl in Hungary, are of the same general nature.

MISCELLANIES.

Brown Hematitic iron-ore, found around cast-iron pipes.—On examining a set of cast-iron pipes, which had lain for some years in the line of one of the streets in the

New Town of Edinburgh, we were surprised to find the sand in which they had been laid, where in contact with the pipes, very compact and brown in colour. On breaking some of the masses, we found the connecting matter to be brown iron-ore; and in cavities of the compacted sand, this brown iron-ore exhibiting that particular lustre approaching to adamantine, and the reniform shape with the granulated surface of brown hematite. Here, then, we have an instance of the formation by the action of percolating water on the iron of the pipes, of an ore of iron which some observers arrange with the igneous mineral formations.

Anatomical Wax Models, &c.—M. M. Portal and Dumeril lately read a report in the Academy of Sciences, which they had framed upon certain anatomical models in wax for the use of surgical students. These models appear to have been moulded with the utmost truth, but the change of colour and fragility attached to them, together with their high price, operated against their general use. M. Ameline of Caen, substituted for wax preparations those of coloured paste of paper, executed with great success, which the reporters deemed to entitle the inventor to encouragement in following up his invention, and that his models should be deposited in the school of design. M. Dupuytren was elected into the place vacant by the decease of M. Percy. M. de la Pilaye presented two MSS. to the Academy, one entitled, "An Essay on the Flora of Newfoundland," and the other on the "Flora of Britany." M. Humboldt communicated to the Academy a notice of the Aerolite of Juvenus, by M. Rose, of Berlin, also the result of certain mineralogical discoveries by the same individual. A report was also made in the Academy of Inscriptions on the best mode of encouraging the continuance of antiquarian researches in France. In the *Society for the encouragement of National Industry*, a medal of gold has been voted to M. Crespel d' Arras for fabricating annually from Beetroot 150,000 lbs. weight of sugar; and another to M. M. Manby and Wilson for having introduced English machinery into France. It is added, that these gentlemen gave great credit to the French workmen, who are represented as making an important progress in their business. The *Asiatic Society*—a Japanese Grammar has been produced, translated from the Portuguese, by M. Landresse; also a Vocabulary in the same tongue, by M. Abel Rémusat.

Ants.—M. Dunau, the French naturalist, in a memoir on the insect tribe denominated Aphis, or Puceron, asserts, in concluding with observations on the relations existing between these animals and the genus *formica*, that the latter insects are perfectly innocent of the injury they are commonly accused of occasioning to the vegetables near which they fix their dwelling. He also adds, that ants are equally innoxious with regard to the pucerons as to trees. They pursue them merely for the purpose of extracting a certain juice or liquor which is contained in their bodies; and in obtaining which they may sometimes use rather too violent a degree of pressure for the pucerons to sustain without injury.

NOTICES TO CORRESPONDENTS.

A. W. Paisley, Rusticus, E. C. &c. have been received. We are obliged to M. A. for his contribution, but inserting it would interfere, he will perceive, with the series of articles on the same subject, one of which has already appeared, and one is in the present No. If, however, he will favour us with observations on these articles, either in explanation or in addition, they will be inserted. We cannot insert the communication of W. G. (as to the beam stands,) in its present state. It contains no account of either the improvements or advantages of those he mentions, and we believe they are too well known to need explanation. His other communication as to the Music Bells, will be inserted in due time.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

" Time is the wise man's gold, and the fool's counters."

No. LXXXV. *Saturday, 6th August, 1825.* Price 3*d.*

UNIVERSAL TIDE DIAL.

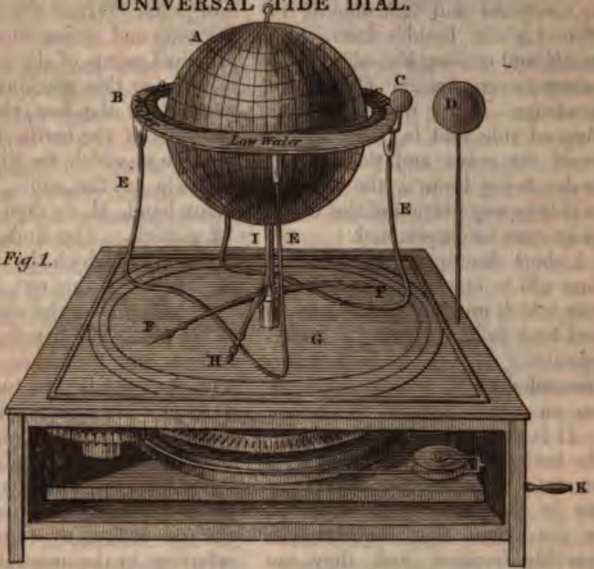

Fig. 1.

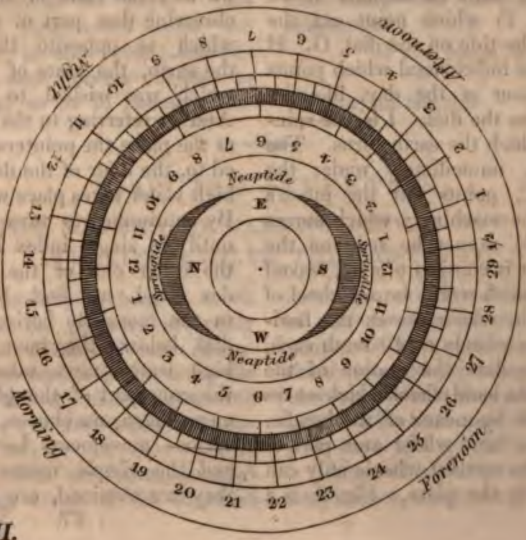

Fig. 2.

Vol. III.

Drawn & Engd by J. Swan.

UNIVERSAL TIDE DIAL.

This very curious machine is the invention of Mr. John Smellie, a very ingenious weaver in Hamilton. Mr. Smellie is entirely a self-taught mechanic, and at his leisure hours has constructed a great many curious machines and instruments of different kinds, besides instructing himself, and making himself versant in almost every branch of scientific knowledge. The design of this universal tide dial is, that on the age of the moon and the hour of the day being known, the state of the tide in any portion of the world can at once be ascertained.

A short description of this machine will at once exhibit the ingenuity which must have been exercised both in its invention and construction. A, (Fig. 1,) is the earth surrounded by B, a moveable horizon, on which is fixed the moon, C; D is the sun. Upon the moveable horizon is painted high and low water alternately, as is partially seen in the engraving. E, E, E, are the wires that support the moveable horizon, and they are connected with the double index hand, F, F, which point out the state of the tide on the dial, G. H is a single index hand which points to the hour of the day, likewise marked on the dial. I is the spindle on which the earth turns. The limb, E, immediately under the moon, C, points out the moon's age. The machinery which moves the whole cannot be seen on the plate, but it consists of a six leaved pinion, which works into a wheel of 177 teeth, which moves the horizon; two wheels of 40 teeth each, which regulate the motion of the earth; and a band wheel, which moves the whole by means of the handle, K. The band wheel and part of two of the teethed wheels only can be seen in the plate. Fig. 2, is a bird's eye representation of the dial, G, with the various markings upon it. The outer circles contain the days of the moon's age divided into halfs. The next circles contain the hours of the day, divided likewise into parts. Within this are marked the neap and spring tides, and the principal points of the compass.

In using this machine, it is necessary, in the first place, to put that part of the earth, the state of the tide at which we wish to know, opposite to the sun. The single index hand, H, is then brought to 12 o'clock. The limb, E, of the horizon on which the moon rests, and which points out her age, is then brought to the day and hour of her age. The handle, K, is then turned, and the single index hand with the earth is then turned round, until it meets with that end of the double index hand, (which is likewise moving, though with a different motion,) which is nearest the limb supporting the moon. When the one is thus over the other, by referring to the moveable horizon, we find the state of the tide, by observing that part of the horizon which is opposite the part of the earth, the state of the tide at which was wished to be known. And by referring to the dial below, at the place the pointers are directed to, the hour of the day at which high water takes place will be seen. By continuing to turn the handle until the single index hand meets the other end of the double index hand, we find, by referring to the moveable horizon, and the dial below, the hour at which high water next takes place in the same part of the globe, and so on as long as we choose. When the various movements here required, and the simple means by which they are obtained, are considered, our readers will be able to appreciate the talent and ingenuity of him who, quite unassisted but by the resources of his own mind, has been enabled to invent and construct this curious machine. We have many other mechanical inventions of this singular individual in our possession, which we shall take an early opportunity of presenting to our readers.

PLAN FOR PROPELLING STEAM VESSELS WITHOUT PADDLE WHEELS.

GENTLEMEN,—I beg leave to submit to you the following plan, as an attempt to remedy some of the defects of the present mode of propelling vessels by paddle wheels, (the loss of power occasioned by which, has already been noticed in your excellent Magazine,) which, if found to succeed, will give much larger space in the vessel, and avoid that commotion in the water which is so injurious to the banks of canals, &c.

Let a boat be constructed with two keelstones three or four feet apart, and having between these an iron tunnel running fore and aft right through the vessel, and open externally to the water at stem and stern, as low as possible, and perhaps declining downwards a degree or two at the stern. This must be interrupted near the fore part of the vessel, branching off and joining again at each side, so as to communicate with two cylinders or force-pumps of suitable dimensions, working alternately and keeping up a constant stream of water through the tunnel. I should conceive that the power of the engine acting against the resistance of the water, would propel the vessel in that manner, as well as by the same resistance acting against floats of the paddle wheels, were the area of the pistons and floats are the same, and in this case the action would be always at the greatest advantage, and so no power lost, besides taking away the water where it accumulates at the bows, and forcing it out at the stern, to prevent that partial kind of vacuum which is forming there, while fast sailing would tend to augment the power, and the vessel would glide along with the least possible commotion.

I am, yours, &c.

E. C.

Glasgow, 11th July, 1825.

DISPUTED INVENTION;

AS TO THE METHOD OF CAUSING DRIVEN AND DRIVING WHEELS REVOLVE THE SAME WAY.

GENTLEMEN,—About a week ago I had the pleasure of seeing the second volume of your Magazine, which certainly is worthy the attention of every mechanic, as well as all those who wish to acquire general knowledge. In this volume, one article in particular attracted my notice, which is the disputed invention, or original claim by two of your Correspondents to the invention of the method of causing the driven and driving wheel to go one way, which they unknowingly conceive to be a new discovery.—(See page 182 and 234, vol. II.)

This method, however, has been long known, as may be seen by reading Buchanan's Essay on the Teeth of Wheels, Gregory's Mechanics, or Camus on Clock Work. These works were published before W. C.'s fishing-pirn, about fifteen years ago, was thought about; before P. F. went to London in 1822, and, consequently, before he "conceived the idea that a wheel driving a pinion, and *vice versa*, and both revolving the same way, without an intermediate wheel, might be of much use in clocks, orerries, and other mechanical combinations."—From what follows in his letter, it appears that his brethren who wrought in wheels, pendulums, and pivots, in London, knew less than himself, and, indeed, nothing about internal pinions and wheels, so of course he knew more than all the combiners of wheels and pinions in the first city of the world.

With regard to W. C.'s fishing-pirn, it appears to me of no consequence whether the line was rolled up by an internal or external wheel and pinion, for, by turning the handle round either way, the same effect would be produced in winding up the line. But it has the attestation of a land surveyor, and of course it must be the first fishing-pirn that ever had the line wound up by an internal wheel and pinion. Therefore, in justice to W. C., I must say that he has the priority of the invention, and that P. F. should not farther dispute it.

Gentlemen.—As I feel a great degree of pleasure in reconciling parties that are at variance, and of settling disputes, would you be so good, as, through the medium of your Magazine, let these disputing inventors know, that if they will take the trouble, or any for them, to come to our good town, and call upon their humble servant, he will show them our gude auld kirk steeple clock, which was made more than one hundred years ago, and, no doubt to their great astonishment, they will there see an internal wheel and pinion which has been working together ever since that clock was made; and, as Gavin Burns the land surveyor says, "I have no hesitation in attesting" that the teeth of the internal pinion and wheel are scarcely altered from the original shape given to them by the maker of the clock, who certainly had a better right to claim the invention, (if he had been living,) than our new disputants, who thus dispute about that which their brother clockmaker put in practice more than fifty years before they knew the difference between a wheel and pinion.

I am, yours, &c.

G. Scott.

Hawick, 4th June, 1825.

LORD BACON AND HIS PHILOSOPHY.

[Concluded from page 393.]

His mind, indeed, was formed and exercised in the affairs of the world. His genius was eminently excursive. His understanding was peculiarly fitted for questions of legislation and of policy, though his character was not an instrument well qualified to execute the dictates of his reason. The same civil wisdom which distinguishes his judgments on human affairs, may also be traced through his reformation of philosophy. It is a practical judgment applied to science. What he effected was a reform in the maxims of state, before unsuccessfully pursued in the republic of letters. It is not derived from metaphysical reasoning, nor from scientific detail; but from a species of intellectual prudence, which, on the practical grounds of failure and disappointment in the prevalent modes of pursuing knowledge, builds the necessity of alteration, and inculcates the advantage of administering the sciences on other principles. It is an error to represent him either as imputing fallacy to the syllogistic method, or as professing his principles of induction to be a discovery. The rules and forms of argument will always form an important part in the art of logic; and the method of induction, which is the art of discovery, was so far from being unknown to Aristotle, that it was often faithfully pursued by that great observer. What Bacon aimed at, he accomplished; which was, not to discover new principles, but to excite a new spirit, and to render observation and experiment the predominant character of philosophy. It is for this reason that Bacon could not have been the author of a system, or the founder of a sect. He did not deliver opinions; he taught modes of philosophizing. His early immersion in civil affairs, fitted him for this species of scientific reformation. His political course, though in itself unhappy, probably conduced to the success, and certainly influenced the character of the contemplative part of his life. Had it not been for his active habits, it is likely that the pedantry and quaintness of his age would have still more deeply tainted his significant and majestic style. The force of the illustrations which he takes from his experience of ordinary life, is often as remarkable as the beauty of those which he so happily borrows from the study of antiquity. But if we have caught the leading principles of his intellectual character, we must attribute effects still deeper and more extensive to his familiarity with the active world. It guarded him against vain subtlety, and against all speculation that was either visionary or fruitless. It preserved him from the reigning prejudices of contemplative men, and from undue preference to particular parts of knowledge. If he had been exclusively bred in the cloister or the schools, he might not have had courage enough to reform abuses. It seems necessary that he should have been so placed as to look upon science in the free spirit of an intelligent spectator. Without the pride of professors, or the bigotry of their followers, he surveyed from the world the studies which reigned in the schools; and, trying them by their fruits, he saw that they were barren, and therefore pronounced that they were unsound. He himself seems, indeed, to have indicated as clearly as modesty would allow, in a case that concerned himself, and where he departed from an universal and almost natural sentiment, that he regarded scholastic seclusion, then more unsocial and rigorous than it now can be, as a hindrance in the pursuit of knowledge. In one of the noblest passages of his writings, the conclusion of his Fragments, " of the Interpretation of Nature," he tells us, " That there is no composition of estate or society, nor order or quality of persons, which have not some point of contrariety towards true knowledge; that monarchies incline wits to profit and pleasure, commonwealths to glory and vanity, universities to sophistry and affectation, cloisters to fables and unprofitable subtlety, study at large to variety, and that it is hard to say whether mixture of contemplations do disable or hinder the mind more."

But, though he was thus free from the prejudices of a science, a school, or a sect, other prejudices of a lower nature, and belonging only to the inferior class of those who conduct civil affairs, have been ascribed to him by encomiasts, as well as by opponents. He has been said to consider the great end of science to be the increase of the outward accommodations and enjoyments of human life. We cannot see any foundation for this charge. In labouring indeed to correct the direction of study, and to withdraw it from these unprofitable subtleties, it was necessary to attract it powerfully towards outward acts and works. He, no doubt, duly valued "the dignity of this end, the endowment of man's life with new commodities;" and he strikingly observes, that the most poetical people of the world had admitted the inventors of the useful and manual arts among the highest beings in their beautiful mythology. Had he lived to the age of Watt and of Davy, he was not of that vulgar and contracted mind as to cease to admire grand exertions of intellect, because they are useful to mankind. But he would certainly have considered these great works rather as tests of the progress of knowledge than as parts of its highest end. His important questions to the doctors of his time were, "Is truth ever barren? Are we the richer by one poor invention, by reason of all the learning that hath been these many hundred years?" His judgment, we may also hear from himself:—"Francis Bacon thought in this manner. The knowledge whereof the world is now possessed, especially that of nature, extendeth not to *magnitude and certainty of works.*" He found knowledge barren: he made her fertile; and he did not underrate the utility of particular inventions: but it is evident that he valued them most, as they are themselves among the highest exertions of superior intellect; as they are monuments of the progress of knowledge; as they are the bands of that alliance between action and speculation, where an appeal to experience and utility checks the proneness of the philosopher to extreme refinement; which teaches men to revere, and excites them to pursue science by their splendid proofs of its beneficial power. Had he seen the change in this respect, chiefly in his own country, produced in part by the spirit of his philosophy, and which has made some degree of science almost necessary to the subsistence and fortune of large bodies of men, he would assuredly have regarded it as an additional security for the future growth of the human understanding. He must always have viewed with complacency these inventions which demonstrated to the most ignorant that "knowledge is power." In the pursuit of knowledge, however, he proposed to himself a practical end, and an end, (even in the modern acceptation of the word,) of unquestionable utility. He taught, as he tells us, the means, not of the "amplification of the power of one man over his country, nor of the amplification of the power of that country over other nations; but the amplification of the power and kingdom of mankind over the world." "A restitution of man to the sovereignty of nature;" (*of the interpretation of nature;*) "The enlarging the bounds of human empire to the effecting of all things possible."—(*New Atlantis.*) From the enlargement of reason he did not separate the growth of virtue, for he thought that "truth and goodness were one, differing but as the seal and the print; for truth prints goodness."—*Advancement of Learning, Book I.*

WATER TRAPS.—TYPHUS FEVER.

The Magistrates of this city, have several times, of late years, applied, to various objects of public utility, the money obtained by letting, during the fair week, the ground in the neighbourhood of the Jail; in particular, we recollect that one year this money was expended in repairing the public wells, and we believe few among the inhabitants were not fully sensible of the benefit derived from these repairs. We are very certain that were the money thus obtained for the present year, applied to the constructing of water traps for the common sewers, the advantage to the public, both with regard to health and cleanliness, would be very great, and would be fully appreciated by every one. The common sewers which have been constructed in the different streets of the city, have been found to be of great utility in many ways; but unless something be done to prevent the effluvia arising from the vegetable and animal putrefactions continually going on within them, from escaping into the atmosphere, they must prove extremely injurious to the health of those residing in the neighbourhood of the different gratings by which the gutters of the streets are emptied into them. There seems to be every reason to think, that the typhus fever, which at times rages so violently in some of the districts of the city, is not contagious or infectious, but is an epidemic; that is, it is not propagated by contact with the person of any one seized with it, but solely by breathing the air impregnated with the poison which produces it. In consequence of this, it is always found to be limited to the crowded, narrow, and dirty lanes and closes of the city; very seldom makes its appearance in any of the well aired quarters of the town, and then only when the individual affected, by some accident or other, has been exposed to the poisoned air. We believe in most cases it has arisen from their being obliged in some way or other to visit the unhealthy districts; but we are by no means satisfied, that it has not often arisen from being exposed to the effluvia arising from the common sewers. It is hardly to be disputed, we think, that any one exposed to this effluvia, for any time, where the air is confined by the narrowness of the street and the closes entering into it, would be seized with the typhus, and there is reason to fear that this may even happen in the best ventilated parts of the town. Now even where there is reason to fear such a thing as this, it is surely very wrong to allow the dreaded cause to remain, when there is a certainty of easily and effectually removing it; and we do think, the Magistrates could not confer a greater benefit on the inhabitants of this large city, than they would by the construction of water traps such as we mention.

Some people may think that our fears are exaggerated, and that no danger can arise from any mere smell thus arising; but we sincerely think our fears well founded, and would strongly urge the necessity of using not the remedy, but the precautionary preventative we have so often urged in the pages of the Magazine. There can be little doubt that typhus fever has increased much these some years back, in this city; an additional building for a fever ward was lately found indispensably necessary for the Infirmary; and a new addition to it is even now contemplated: we have never heard this increase of fever attributed to the introduction of common sewers, *but we have often thought it might with truth be so attributed.* It is very praiseworthy to erect fever hospitals for the reception of those affected with this malady, which is just a species of the plague; but prevention is always better than cure, and if proper means are used, we see no reason to doubt that it might be almost entirely extirpated; at least, it might be confined entirely to the most dirty and low lying parts of the town. As a first step towards this, we would prevent the atmosphere from being polluted by the effluvia of the common sewers: and as a second, we would, if possible, try to convince the public, and particularly the working classes, that typhus fever does not arise from contact with the person of those affected with it, as small pox, measles, and some of the infectious fevers do; but entirely from breathing or being exposed to the atmosphere which has been poisoned or affected, however it may be, so as to produce this disease; and consequently, that were there general cleanliness and plenty of fresh air, with sufficient food, such a disease would hardly be known. We conceive it of great importance to inculcate as an undoubted truth, that typhus fever really never seized any one merely from being about the person of the infected, unless there was a want of fresh air, and the atmosphere thus became destroyed: but we conceive it also of the last importance, that the sewers should be prevented from sending forth their pestilence upon the unconscious inhabitants residing in the neighbourhood of their various openings.

It is unnecessary for us to give any plan for water traps at present, as we have already given various; our sole design, just now, is, if possible, to call the public attention to this great and growing evil; and, we sincerely hope that our Magistrates, and the active and intelligent Superintendent of Public Works, may pay attention to what we have said, and do something towards remedying the evil.

RAM'S HORN CHURCH.—PEEL OF BELLS.

THE want of a peel of bells in Glasgow has been long observed by every stranger who visits this city; and who, happening to sojourn here on a Sabbath, hath his ears tortured with the jangling and jarring of the multifarious bells which on that day, from hour to hour, are set a ringing. Any person who has heard the grandeur and solemnity of a peel of bells in some of the English Minsters or Cathedrals, "swinging slow with sullen roar," as Milton hath it, must join with us in wishing that we had, at least, one peel in the city to call us to church. Indeed, so jarring and dissonant are the bells which are at present used, that we would much rather see the Moslem plan adopted, and be called to church by the sound of a human voice, from the top of the steeple, as the "faithful" are, by a voice from the top of their minarets, than have it as it now is.

It was, we believe, intended, when St. John's was built, to have a peel of bells in the tower of that church, but it was afterwards ascertained that from the nature of the foundation, it would be dangerous to attempt hanging them up. The bells were, however, we understand, ordered and actually cast for the purpose. We have heard they are still lying somewhere about town; we trust this is the case, and that those in authority will see the propriety of hanging them in the tower of the New Ram's Horn Church. This church is certainly by far the most chaste and beautiful building with which the city has for a considerable time been adorned. Were it enriched with a peel of bells, we are very certain it would meet the wishes of the citizens. We have never heard how it is intended to finish the inside of this church, but we hope that some care will be taken to make it in accordance with the outside. It is a painful disappointment when one sees a building with a beautiful Gothic outside, and the inside like a modern hall. Surely the expense will never stand in the way of ornamenting the inside of this new church.

ESSAYS ON BLEACHING,

By James Rennie, A. M. Lecturer on Philosophy, &c. &c., London.

No. III.—CHEMICAL AGENTS USED IN BLEACHING.

SECTION II.

Of the Vegetable Alkali.

There is nothing in which the mere manufacturer who is not a chemist is more at a loss than in ascertaining the quality of his alkali; in discovering the proportions of efficient material in a given quantity of the alkali of commerce. To the chemist, however, it is not a task of insuperable difficulty; and he, therefore, ought to lend all the aid in his power to simplify the process of analysis.

The vegetable alkali of commerce possesses very different qualities, according to the manner in which it is manufactured, and the vegetables from which it is procured. This substance may be extracted in greater or less quantity by lixiviation from the ashes of almost all vegetables, and pre-exists in plants previous to combustion; not indeed in a separate uncombined state, but united with the sulphuric and muriatic acids, and sometimes the nitric, but more commonly with a vegetable acid or oil in the state of a neutral salt. These salts seem to be decomposed during combustion, (their own carbon probably acting as a powerful agent,) and the alkaline part is thus set free. When the sulphuric acid is a part of the compound, the combustion sets free its oxygen, and sulphur is produced, which unites with the now disengaged alkali and forms a sulphuret. This substance, Mr. Kirwan says, (Trans. R. Ir. Acad. 1739,) is more readily produced when free access to the air during combustion has not been given. Formerly the potash and pearl ash of commerce were supposed to be pure simple substances. In 1756, Dr. Black proved satisfactorily that they *all* contain a large proportion of carbonic acid. This may be shown by a very simple experiment. Pour a little of the clear solution of carbonate of potash in a glass of transparent lime-water, when the lime will be instantly converted into chalk by abstracting carbonic acid from the potash. M. Descroizilles found that American pearl ash consists of a mixture of caustic soda and muriate of potash. (Ann. de Chim. LX. 17.)

This alkali is procured from North America, Russia, and other countries which abound much in forests; and is manufactured by incinerating and lixiviating the wood which is cut down in order to clear the land for cultivation. The pot and pearl ashes of commerce, which differ in the latter being milder in consequence of a superabundance of carbonic acid, are brought to market of three different qualities, but the manufacturer would fall into a gross mistake were he to suppose that those of the first quality, for example, contained a uniform quantity of pure alkali; this can only be learned by the actual analysis of a specimen taken from every parcel he may have occasion to purchase. At the very commencement of the examination of a parcel of ashes by the eye, the bleacher ignorant of chemistry is often much deceived in the estimate he forms of their quality; for, by following an unlucky prejudice, he prefers that which exhibits a red fracture, which can only be occasioned by oxide of iron, or by sulphur. Now, either of these substances, every bleacher knows will greatly injure the cloth in every stage of the process. In order to humour this hurtful prejudice, some of the manufacturers of alkali in England adulterate with sulphur, to produce this red fracture, and procure a reputation for their goods. By this means, the bleacher is not only induced to give a high price for an inferior commodity, but before he can employ such alkali in any of the nicer operations of his art, he must get clear of the sulphur and the neutral salts which it may have formed. Even the best ashes never contain above 70 per cent. of alkali in a state of purity, and seldom more than 60 or 65. Of the adulterating substances, charcoal is perhaps the most common; but as it commonly exists under its proper appearance, it can readily be recognized by the *eye.* Water is always present in the proportion of about 5 or 6 per cent. The rest of the foreign substances commonly consist of carbonic acid, sulphate and muriate of potash, and muriate of soda. The last of these is often added by the seller for the purpose of increasing the weight, especially to those which are contained in the casks marked of the second and third qualities. M. Descroizilles informs us that the casks and packages are not always of the same quality in their different points and various pieces; for the ends of a cask and its centre towards the bung, have been found to contain good potash, while the other parts were either of inferior quality, or, what was worse, contained nothing but earth. (Ann. de Chim. LX.)

Several methods have been proposed by eminent chemists for ascertaining the proportion of efficient alkali in the ashes of commerce. If it be required to ascertain whether any lime exists in a parcel of ashes, dissolve an ounce of them in boiling water, and put into the vessel a single drop of the oxymuriate of mercury; if lime be present, a yellowish brown colour will be produced. (Kirwan.)

Mr. Kirwan (Trans. R. I. A. 1789, p. 15) recommends one founded on the principles that a hot solution of a free alkali, or one combined only with carbonic acid gas or sulphur, can hold no earthy or metallic neutral salt in solution; that alumina cannot be precipitated by the hot solutions of any alkaline neutral salt, but only by free alkali, or such as contains sulphur or carbonic acid gas; that any carbonic acid gas taken up by the alumina, is separated in drying, or may be disengaged by the muriatic acid, and that the strength of an alkali is in proportion to the quantity of any acid required for its saturation. For the analysis, then, procure a pound of alum, reduce it to powder, wash it with cold water, put it into a teapot, and pour on three or four pounds of boiling water. Powder an ounce of the alkali to be tried, put it into a Florence flask, with a pound of distilled water, (which the bleacher can have from his steam engine,) boil the liquid for an hour, and filter it. Both this and the solution of alum being heated gradually, pour in the latter till the liquor redden litmus paper. Dry the substance which is obtained by filtering this solution, reduce it to powder, and keep it in a heat of 500° for a quarter of an hour. Place in the same scale of a balance with this, after weighing it alone, an ounce flask filled with muriatic acid, and balance them by weights on the opposite scale; mix the alkali and the acid, blow into the vessel, to expel the carbonic acid gas which may have accumulated, (see Nich. 4to. Journ. I. 271,) and mark how much it takes to restore the equilibrium. This subtracted from the weight of the dry alkali, will leave as a remainder a weight exactly proportioned to the weight of pure alkali contained in an ounce of ashes; all besides is foreign matter. This, however, is liable to some inaccuracies, for if quick-lime be present, it will decompose the alum. Whether this be the case can be discovered by the oxymuriate of mercury, or by the addition of a few drops of any mild alkaline solution, by which it will be readily disengaged. Again; if sulphur be present, it will be precipitated along with the alumina, and increase its weight. This test, however, of the strength of alkalies can never be a standard of much accuracy, unless the acid employed be always of the same strength. This may be done with sufficient exactness for ordinary purposes, by diluting the acid *to the same degree by the* hydrometer. Let the test, for instance, consist of one part of acid and five of water. When the mixture has cooled down to the temperature of 60°, observe the height to which the hydrometer rises, and make this the standard for subsequent trials.

M. Descroizilles has given a long account of an alkali meter, invented by him, in the sixtieth tome of the Annales de Chemie, but I do not know whether it has ever been brought into use; a description of it may be also seen in the Philosophical Magazine for 1807.

There has been another method proposed for discovering the purity of the vegetable alkali: a given quantity of potash in twice its weight of water; stir the mixture during the solution of the salt, and filter it while warm through blotting paper, adding gradually, after all the liquor has passed through, a small quantity of cold water to wash out the remaining alkali. What remains on the filter is sulphate of potash, which, after being dried, must be accurately weighed. The clear solution which has passed through the filter is evaporated in a sand bath till it is reduced one-third, and set in a cool place for 24 hours, when, if the crude alkali contained muriate of soda, it will be found crystalized at the bottom of the vessel in a regular cubical form, which also is to be dried and weighed. The weight of this, together with that of the sulphate of potash formerly obtained, being deducted from the weight of the crude material, will give the precise weight of the pure alkali which it contains. Pearl ash being milder than potash is commonly preferred for any of the nicer processes in bleaching. The pearl ash is prepared by a longer continued calcination of the materials of potash at a low heat, by which the combined sulphur and carbon are expelled or decomposed. The pearl ash of Russia and America, however, contains a large proportion of neutral salts, of which the bleacher must endeavour to deprive it. Several extensive works have lately been established for the purpose of preparing this for the use of bleachers and others; and the article can be afforded as cheap as the foreign, and much purer.

M. DUPIN'S ADDRESS TO THE MECHANICS OF PARIS,

Delivered in November last, at the Conservatoire Royal Des Arts et Metiers.

[Concluded from page 398.]

We are compelled to confess, that fourteen millions of English and Scotch have more industry, and produce a greater number of articles, to convey to distant countries by their commerce, than thirty or forty millions among the greatest part of the people of the continent. Behold then why fourteen millions of English and Scotch have been able to contend with advantage, both during peace and war, against adversaries so much more numerous.

Let me not be accused of placing too high British industry, and too low the industry of other people. I leave you to judge, gentlemen, if I am the friend of my country, by the considerations themselves which I now submit to your examination, and by the motive which animates me. Far be from us the empty declamations of those writers and those orators, who sacrifice truth to render themselves popular in our assemblies, in our saloons, in our manufactories. They speak to us decidedly of our superiority in every thing: they repeat to us, even until we are disgusted, that we are the first people in the world. Without doubt we have every thing which enables us to become so; but at this instant, so far from being in the first rank, I fear that we are surpassed, and very much surpassed, by England.

England has arrived at a remarkable epoch, which has prepared for her a destiny new and more magnificent than all her prosperity hitherto obtained during war and during peace. Now, in Great Britain the whole industrious class is awakened to a new existence: it is snatched from routine, and withdrawn from ignorance. The principles and the applications of the useful sciences are unfolded to it. This class receives *with avidity* the fruitful lights which *are presented to it.* It is not as a pensioner, and by way of a gratuitous favour that it receives these inestimable gifts. So well does it appreciate the value of them, that it pays for obtaining an education, the great importance of which it has fully recognised.

Let us pause a moment to contemplate a spectacle which no other people on the face of the earth has ever before presented. Let us direct our eyes to the future—we have no occasion to advert to times very remote. It is superfluous to ask us now what the new instruction conveyed to the British nation will produce in fifty or a hundred years. Let us ask only what this instruction will have produced in twenty years.

Let us suppose that the scientific instruction of the artizans should not take a greater range, although every month offers to us a new progress made in this career. I see schools of industry open to the working class in the great cities of London, Edinburgh, Glasgow, Aberdeen, Manchester, Birmingham, Lancaster, Leeds, and Newcastle; let us suppose that these towns furnish instruction to only five thousand artificers yearly.

In twenty years, Great Britain will reckon a hundred thousand artizans, of every kind, who will have acquired a knowledge of the scientific elements useful to industry. Among these hundred thousand men, many will forget what they have learned; be it so. Many will be incapable of making an advantageous application of them; granted likewise. But the artizans to whom nature hath given qualifications favourable for the combination of number, of forms, or of forces, will have in their hands an instrument, which will serve as a lever for their genius; and we shall be astonished by the effects which this instrument will produce.

Three cities less extensive than Rouen, than Lyons, than Nantes, than Bourdeaux, than Marseilles, than Strasburgh, Athens, Florence, Geneva, in spite of the numerical weakness of their population, have become, in ancient times, in the middle ages, and in modern times, just objects of admiration, for the prodigious number of their men of science, of their men of letters, and of their artists. Not because human nature exhibited herself more productive of superior minds, upon the shores of the Ægean sea, of the Arno, or of the Leman lake, but because instruction was there more widely diffused.

But in Athens, Florence, and Geneva, this instruction was never completely developed amongst the lowest classes of society. It was only amongst about a thousand select citizens that knowledge was allowed to exercise her benefits.

In Great Britain, industry includes in her manufactories, at least four millions of individuals, who are all equally invited to partake of this new scientific instruction. Among these four millions, every man who shall feel within himself a peculiar disposition to apply the principles of knowledge to the practice of the arts, may, at the present time, with the most moderate sacrifice, acquire, during the hours in which he has ceased to labour, means of rendering this labour less deteriorating to the mind, and more productive.

I dare venture to predict, that in the greatest branches of industry, unexpected, incalculable advances will be the immediate consequence of the new instruction furnished to the British people. Let us judge of that which will happen, by that which has already happened.

Until lately in Scotland, popular instruction was confined to reading, writing, and arithmetic; but these elementary parts of knowledge were general. Well; they have sufficed to enable a multitude of illustrious talents to separate from the crowd; to immortalize their country, and at last to place it in the foremost rank among the nations which accelerate the progress of the sciences, of literature, and of the arts.

A professor of Glasgow, Black, creates pneumatic chemistry, and prepares those immense benefits which this science confers on industry.

A professor of Edinburgh, Smith, produces a complete change in political economy, and prepares for the commercial regulations of his country, the great revolution which is taking place at this moment.

A mathematical and philosophical instrument maker, Watt, a Scotch engineer, proceeds to make of the steam-engine the most powerful and the most useful prime mover for the service of modern arts.

Observe, gentlemen, that these modern inventors have all sprung from the industrious class; whilst before the higher classes of laity and the clergy could alone furnish men who were sufficiently instructed to add by their discoveries to the progress of the human mind. The monk, Roger Bacon, invented gunpowder: Lord Napier invented logarithms: two great discoveries which have changed the labour of mathematics, and the moral state of society.

I dare to predict, that in the next twenty years, the conquests of science and industry in Scotland and England, will surpass those of the generations which have given so much prosperity to the British people.

The only question we have to ask is, whether we shall remain behind in this immense progress; or whether we will proceed upon the same line, in order to outstrip, if it is possible, a people whom nature has made our rival in every species of glory?

The facts which I have stated, respecting the dispositions of the working classes in France, leave no doubt of the facility of instructing the simple workmen, in the happy country where natural intelligence is so lively and so penetrating; where the memory is susceptible of such various and numerous impressions.

Now, gentlemen, all of you who are united in this league—it is to you to whom I address myself. I make you the depositaries of the great expectations which your country must form of you. I ask you, in its name, to render it more happy and more opulent, in adding to your comfort and your welfare; to render it stronger and more splendid, by making a more intelligent use of your moral and physical powers.

May my voice excite in your minds those generous emotions, and those profound impressions, from which energetic and durable determinations arise. It is you on whom the industry of France calls to set her the example: you are the chosen of the labouring classes of the capital of a great and powerful kingdom: become for all the nations of the world the chosen of all the labouring classes, by adding the powers of the mind to those of the body. A new contest is to be begun. Often have you been the conquerors of the most warlike people upon the field of battle, show that the children of our workmen know how to excel also in wielding against the enemies of their country, the arms of war, and the instruments of glory. At present, let us seek only to handle and direct well those of opulence and of peace.

You see united in this league, in order to encourage you by their presence, the most eminent of geometers, of astronomers, of chemists, and of philosophers, who have gained in the career of science, prizes which are also the glory of France. Behold your masters and your fathers: those great founders of our finest establishment of industry, of whom the greatest part have begun to live like yourselves by the labour of their hands. Now, thanks to the power of their understanding, they employ your hands by thousands, and show you the path to which an honest and just ambition directs you. All these men, eminent in their various pursuits, accord with me in their wishes and in their hopes, it is for you—it is for us, to realise their generous desires, and their patriotic hopes. I will on my part do all that my studies and my limited experience will enable me to accomplish.

At this time, gentlemen, France possesses engineers or officers, provided for the civil and military departments by the Polytechnic School; the principal part of these are in a situation to deliver courses of lectures for the service of the artizan, according to the plan which I have chalked out for this Institution. The greatest part would be able to add to it the fruits of their observation, and of their experience in the important public services which they have directed, or which they do still direct.

Amongst these four thousand engineers, it will be sufficient to find only one or two well disposed towards this undertaking, in each of the industrious cities of Rouen, of Lille, of Saint-Quentin, of Lyon, of Saint-Etienne, of Toulouse, of Bourdeaux, of Marseilles, of Nantes, of Montpellier, of Nimes, of Grenoble, of Colmar, of Strasburgh, of Metz, to enable the industrious class to enjoy an education, similar to that which we this day commence. By this combination of efforts and instruction, the lights of science propagated at once through all the centres of our industry, will supply processes enabling us to obtain for our productions forms more exact and more perfect, for our tools, for our instruments, for our machines, applications more easy and more powerful. By every where familiarising our artists with the principles which ought to direct them in their labours, we shall furnish them at once with methods for perfecting the object formed, and the practice of their formation. Let us leave to the future the care of disclosing to us the happy fruits of these new elements of prosperity.

If these ideas, which I delight in entertaining, are soon realised, I shall feel one source of pleasure, in which you will participate: it will be, to see the new era of this prosperity, bearing for its date, the first year of a reign, of which the dawn smiles upon the generous hopes of every enlightened Frenchman.

ON THE CARTESIAN THEORY OF THE MOTION OF THE PLANETS.

GENTLEMEN,—In Number LXXXII. of your Magazine, there is a paper by R. B. on the motion of the planets, and on which, with your permission, I now mean to make a few remarks, and to point out a few objections to the Carte-[illegible] theory which, in all probabil-[illegible] r to your Correspondent before he agreed to its truth.

What has confirmed R. B. in this opinion appears to have been the failure of an experiment detailed in Ferguson's Lectures on Mechanics. Of the whirling machine I know nothing, but it is surely a well known truth, that the success or failure of a mechanical engine, cannot, as he seems to indicate, confirm or refute the theory to which it has been adapted. Indeed, few things have tended so much to perplex philosophy as an unlucky propensity to gather truth from experiment rather than from reasoning; though desirous of knowledge, we are willing to purchase it at the easiest rate, and we choose experiment in preference to reasoning, because it shortens and renders less laborious the road to knowledge. This bent of the mind is productive of manifold errors. Prepossessed once in favour of an opinion which seems to be confirmed by a chance experiment, we are no longer open to conviction; every train of reasoning must be accommodated to that experiment, and every argument against it, however strong, must go for nothing. Thus endeavouring to mould nature to our wish, instead of endeavouring to acquire a true knowledge of her genuine figure. But let me not be understood to assert, that facts and experiments are to be disregarded as useless and unprofitable lumber: that would be carrying the matter to an opposite; and even more dangerous extreme. Theory and experiment are so interwoven with each other, that when we place too much confidence in either, or when we attach ourselves to one beyond what the other can justify, they become only an endless source of contradiction and error.—In short, theory is vain without experiments, and experiments are best understood by applying them to theory.

The opinion of Descartes was, that the planets were retained in their respective orbits, by means of a fluid which, rapidly and continually circulating around, carried them along with it; which opinion was strengthened, as your Correspondent justly remarks, by the apparent motion of all the bodies in the solar system; the sun is seen to turn upon his axis in the same direction with the planets, and we may also observe that the earth, Jupiter, and Saturn, revolve in the same direction with their satellites. Farther, Descartes supposed that the sun, in revolving upon its axis, communicated motion to that part of the fluid which was contiguous to it, and afterwards propagated the like motion to parts more remote. In like manner, he supposed that the earth by its rotation, might communicate motion to the fluid, at a sufficient distance to carry round the moon, and the same of Jupiter and Saturn.

Against this theory it has been objected, that the velocities with which the parts of this fluid in different distances from the centre of the motion, will not agree with the motion observed in different planets; for example, that the time of one entire circulation of the fluid wherein Jupiter should swim, would bear a greater proportion to the time of one entire circulation of the fluid where the earth is, than the period of Jupiter bears to the period of the earth.

Again; a planet could not circulate in such a fluid, so as to keep long in the same course, unless the planet and the contiguous fluid were of the same density. Now, that the earth does not swim in a fluid of equal density with itself, is abundantly manifest: were that the case, all bodies put in motion upon its surface, would suffer a great resistance from it; but it is well known, that bodies falling perpendicularly sustain only about $\frac{1}{850}$th part of the resistance which is offered to the same bodies falling through water, of which the density is not so great as that of the earth.

It would also be necessary that there should continually exist some vivifying principle in the centre of motion; for the sun, by imparting motion to the circumambient fluid, will itself loose just as much as it imparts to the fluid, unless some active force should constantly renew it. If the extension of the fluid be supposed infinitely great, the gradual loss of motion would continue till the whole should stop; if it were limited, the motion would continue till there would remain no swifter revolution at the sun than in the farthest part of the fluid, so that the whole would turn together about the axis of the sun like one solid globe.

Lastly, as the planets do not move in perfect circles round the sun, there is a greater distance between them in some parts of their orbits than in others. Thus, the distance between Mars and Venus, in one part of their orbits, is nearly half as great again as it is in the opposite part. Now, here the fluid in which the earth should swim, must move with a less rapid motion where there is this greater interval between the contiguous orbits; but, on the contrary, where the space is narrowest, the earth moves more slowly than where it is widest.

But I have already trespassed too much upon your time, and I trust enough has been said to show at least the extreme importance of the Cartesian theory; a theory which appears to have been adopted without much consideration, but to support which, much labour and pains have been bestowed by men of learning and genius.

Yours, &c.

MECHANIC.

LETTERS AND QUERIES.

GENTLEMEN,—I beg to inform W. C., in answer to Query in No. LXXVIII. of your Magazine, that chopped hands may be cured by rubbing them in *melted ox-marrow*, or hog's-lard, or other unctuous substance. If the chops on the thumbs or fingers are deep, the horny parts should be pared off near to the quick, and leather gloves worn at night, if it cannot be done through the day. In order to obtain the ox-marrow, take a marrow-bone before it turns stale, take out the marrow and melt it over a slow fire in an iron pot, or in a potter's vessel, set in boiling water over the fire; when melted, strain it into a jelly pot through a bit of muslin. It is free from bad taste or smell, and is a precious ointment for chopped lips, or for almost any purpose in which hog's-lard is used; it keeps long sweet and good, if covered up from the dust.

A. B.

Paisley, 21st July, 1825.

GENTLEMEN,—I am a land surveyor, and the little I know of it I have picked up by my own industry. I am very much at a loss to get houses, &c. drawn correctly; and having seen a description of Woolaston's Camera Lucida in your useful Magazine, I would be under infinite obligations if you would answer the following Queries:

Would the Camera Lucida be useful in taking objects at one or two hundred yards distance? Would it embrace an object of moderate size, such as a house, castle, church? Could it be used in the fields without a table? Where are the best instruments to be had? What is the price of a common one, and a finely mounted one?

I am, yours, &c.

RUSTICUS.

Glasgow, July, 1825.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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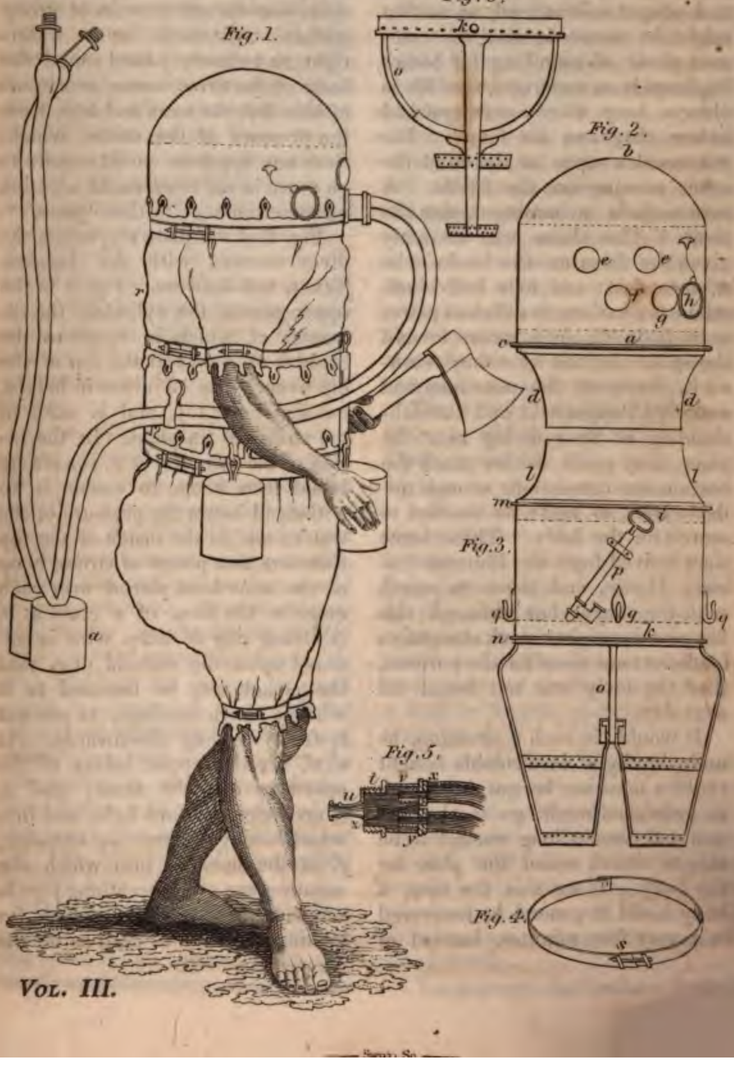
THE GLASGOW
MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

> " He sunk! the impetuous river rolled along—
> The sullen wave betrayed his dying breath;
> And rising sad the rustling sedge among,
> The gale of evening touched the chords of death!"

No. LXXXVI. *Saturday, 13th August,* 1825. Price 3*d.*

DIVING MACHINE.



Swain Sc.

DIVING MACHINE.

Hardly a day occurs in which there is not one or more individuals drowned bathing in the river. Although there may be many persons on the banks when such an accident occurs, probably not one of them can swim, so that before any boat or other assistance can arrive, the unfortunate individual in the water is irrecoverably lost. Often, even after they have sunk to rise no more, could the body be got out, and proper means used, animation might be restored; but the common mode of searching for bodies by drags is so uncertain, that life is always long utterly extinguished before they can be found. We witnessed a scene of this kind the other evening on the Clyde. A man sunk in swimming across the river. The alarm was instantly given by those on the banks who witnessed it; and four individuals who were bathing in different places at a little distance swam toward the spot. By the time they reached it, however, the poor man had entirely disappeared; and notwithstanding of their diving near the place, they could neither reach the bottom nor remain long enough under water, so as to be enabled to search for the body. Three boats then arrived from the Humane Society House, and began to search with the drags; but although this happened at eight o'clock at night, so inefficient are these for the purpose, that the body was not found till next day.

It would, in such a situation, be undoubtedly of incalculable benefit could a machine be got by which an individual might go to the bottom and remain long enough to be able to search round the place for the body. Were this the case, a body could in general be recovered in a very few minutes, instead of its being hours, as is almost invariably the case at present. We have seen a machine, invented many years ago by a person in Germany, which might answer the purpose very well. It consists of a sort of harness made of strong tin plate in the form of a cylinder, which goes over the diver's head, and consists of two parts, that he may conveniently thrust his arms through it, and put it on; also a jacket with short sleeves, and drawers of strong leather. All these being water-tight, and closely joined round the body of the diver, secure every part of him, but the arms and legs, from the pressure of the water, which, from any depth he would require to go down in our river, could occasion no inconvenience to these parts.

Fig. 1 of the plate represents the diver covered with the harness, jacket, and drawers. Fig. 2 is the upper part of the cylinder, the diameter of which is equal to the breadth of a man at the top of the hip bone. It is 15 inches in height, has a globular top, and is made of the strongest tin plate. In the inside of the cylinder, at *a*, is a strong broad iron hoop, to enable it to withstand better the pressure of the water; and in the inside of the top there are two pieces of strong hoop of the same kind placed over each other in the form of a cross at *b*. A strong ring of brass wire is soldered upon the outside at *c*, that the jacket may be fastened to it with an elastic bandage, to prevent it from slipping downwards. At *d*, *d*, are the upper halves of the apertures for the arms; and *e*, *e*, are holes to afford light, and into which the eye-glasses are screwed; *f*, is the opening into which the mouth-piece of the breathing pipe is screwed; and *g* is an aperture for looking through, as well as for the purpose of breathing by when out of the water, and which, by means of the cover, *h*, suspended from it, can be screwed up before the diver enters the water.

Fig. 3 represents the under part of the cylinder, which is also 15 inches in height, and which, at *i* and *k*, is strengthened by iron hoops in the inside, in the same manner as the former. To the lowest hoop, *k*, are soldered four small rings, to which are fastened strong leather straps, three inches in breadth, that can be buckled cross-wise over the shoulders, and support the whole machine; *l*, *l*, are the under halves of the apertures for the arms; *m* is also a ring of brass wire soldered to the cylinder, which serves to keep fast the jacket when buckled on, and to support the upper cylinder, (fig. 2,) which slips over the under one, and on that account, the under one is a little smaller, so as to fit into the upper one. There is also another such ring at *n*, in order to prevent the drawers from falling down.

At *o*, (fig. 2 and fig. 6,) is a strong semicircular piece of iron, the use of which is to prevent the drawers, when pressed by the water, from touching the under part of the body, otherwise the pressure, even at the depth of six feet would be insupportable. As it is not possible to sew the leather so closely as to prevent water from forcing its way through the seams, a small pump is suspended at *p*, for the purpose of pumping out the water when it has risen to the height of a few inches in the lower cylinder. Four hooks, *q*, *q*, *q*, *q*, soldered to the lower part of the cylinder, are for the purpose of suspending weights from them.

The jacket, *r*, (fig. 1,) with short sleeves that cover the upper part of the arms, serves to prevent the water from penetrating through the joining of the cylinders, where the one is inserted into the other, as also through the holes for the arms, as it is bound fast round both parts of the cylinder, and likewise round the arms. The case is the same with the drawers, which are bound close round the knees.

Fig. 4 represents a brass elastic bandage, employed for fastening on the jacket, and which, when hooked together, is screwed fast by means of the screw, *s*, three inches in length. A brass bandage is here used, because leather is apt to stretch, and on that account might be dangerous.

Fig. 5 is the mouth-piece to which the pipes, *x*, *y*, are fastened, and which are screwed on at *f*, (fig. 2;) *t* is the screw; *u*, the part that goes into the machine, and which is taken into the mouth; *v*, the exterior part of it, in which there is a partition, *w*, in order to separate the pipes; and *z* is an aperture that the air in the machine may communicate with the pipe, *y*.

The internal diameter of these tubes is three-fourths of an inch. They consist of strong brass wire, 1½ bore in thickness, wound into a spiral form, and covered with strong leather. In order to save expense, six yards of the pipe, from the mouth-piece, may be made in this manner, and the rest of tubes of tin plate, three or four yards in length, joined together with pieces of leathern pipe about a foot in length, prepared in the first manner.

The reservoir, *a*, (fig. 1,) applied in such a manner that it can be screwed off, is for the purpose of collecting the small quantity of water that might force itself into the breathing-pipe when long used, and which otherwise would be in continual motion, and render breathing disagreeable.

To prevent the leather from becoming hard, and to close up its pores, so that it may be rendered water-tight, the following mixture may be rubbed over it: *viz.* six parts wax, two parts Venetian turpentine, two parts pitch, and two parts melted hog's lard. It is also to be observed, that the best and strongest leather must be used for the tubes, and that stripes of leather must be sewed very closely on the seams of the jacket and drawers.

In using this machine, the diver must first be made acquainted with its parts; and after having put it on, and suspended the weights, let him enter the water at any convenient place, and advance till it reaches to his eyes, while the end of the pipe is held by a person on the bank. If the diver can then breathe with ease, and if no water forces itself into the pipe, which must be left to float on the water, he may proceed till it covers his head, having first taken the precaution to tie a strong rope to one of his arms.

After this he may gradually go deeper and deeper, making signals that he finds himself at ease, by pulling the rope, or by speaking through the pipe. If a man exercises himself in this manner for several days successively, still increasing his depth, he will soon be able to dive boldly, and to move under the water with ease and freedom. When he wishes to ascend, he needs only unhook one of the weights, which will then drop to the bottom; and being then lighter than an equal volume of water, he will rise to the surface. To preserve the weight from being lost, a particular rope must be employed which may be let down to the diver upon his making a certain signal, and which he may fasten to the weight before he unhooks it. One thing farther is to be observed in the use of this machine, that the diver must suffer the air inhaled through the mouth-piece, *u*, to escape through his nostrils into the machine. The next time he draws breath, the air in the machine will be forced out from it at *z*, (fig. 5,) by the distension of his body, and will escape by the other pipe.

Were a machine of this kind procured by the Humane Society, their keeper could very soon learn to use it, and it might thus prove the means of saving many lives. Besides this, we would recommend that watchmen should be placed along the banks of the river to lend assistance and give an alarm in case of need. There is much necessity, for many reasons, that a portion of the police should have the charge of the river in the neighbourhood of the city: and a few river watchmen would be an addition to the police establishment which we think few people would complain of.

ON THE IMITATION OF THE GRECIAN ARTISTS IN PAINTING AND SCULPTURE.

No. I.

True taste may be said to have had its rise in Greece, and to have arrived there also to its highest perfection. The inventions of other nations, when communicated to the Greeks, were no more than rude *essays, that* acquired, under the *auspicious* influence of Grecian *genius,* a new form, and new accessions of beauty, grace, or utility. Minerva, it is said, chose for the residence of her favourite people, that agreeable climate, as the most adapted to favour the progress of wit and genius, on account of that mild and happy temperature that reigns there in the different seasons.

The exquisite taste that appears

in the productions of the Grecian artists, has been in a great measure peculiar to them. It has rarely been transmitted to other nations without losing something of its native excellence; and its pleasing light made its way but late into the northern regions.

The imitation of the ancients is the only way of excelling in the sublime and elegant arts of painting and sculpture; and we may say of their productions, what has been said of Homer, that the more we study them, the more we must admire them, as true beauty appears most to advantage when it is strictly examined. In order to admire the Laocoon, as we admire Homer, a man must have such an acquaintance with that famous statue, as he has with an intimate friend with whom he daily converses. Nicomachus passed an hour or two every day with the Helen of Zuexis; and on hearing a person find fault with the composition of that famous picture, "Take my eyes," said he, "and you will think her a goddess."

It was with such eyes that Michael Angelo, Raphael, and Poussin, beheld the productions of the ancient artists. They looked for taste, truth, and beauty, at the fountain head. Raphael sent several excellent designers into Greece to draw for him all the precious remains of antiquity that has escaped the waste of time.

It must not, however, be imagined that the most capital productions of the famous painters and sculptors of ancient times are free from defects. These defects are even more numerous than is generally apprehended; though they are, as it were, lost in a blaze of beauties, and scarcely attended to amidst those sentiments of admiration that the masterly part of each production excites. Some of the *greatest painters* and sculptors of antiquity confined their efforts to the principal figure of each piece, and often neglected the rest. Who would imagine that the dolphin and the cupid that are seen at the feet of the Venus de Medicis, were the work of the same chissel that gave perfect grace and perfect beauty to that immortal form? Look at the greatest part of the medals of the kings of Egypt and Syria—nay, at those where the workmanship is most exquisite, and you will perceive the heads highly finished, and the other parts of the medal much inferior in beauty and grace. We must consider the productions of some of the greatest artists of antiquity, as Lucian did the Jupiter of Phidius: he admired the God, without looking at his footstool.

It has been given as a rule necessary to the perfection of painting, that imitation must follow, not merely nature, but nature in its most striking and perfect appearances—in its most grand or agreeable forms—in a word, *select nature*, if that expression may be used. But those who are capable of judging of the productions of the Grecian artists, and who endeavour to imitate them, will find not only this select nature in them, but something still more transcendant and sublime; they will find in them that ideal beauty, of which the model is not visible in external nature, and which, as an ancient commentator of Plato tells us, is only to be found in the human mind, where it was originally implanted by the primitive source of eternal beauty.

The most beautiful and best proportioned human form that is to be found in modern times, would perhaps resemble the most beautiful body among the Greeks, no more than Iphicles resembled his brother Hercules. The gentle temperature of a pure, mild, and serene atmosphere, had, no doubt, a certain influence on the bodily constitution of the ancient Grecians; and the manly exercises to which their youths were accustomed, brought to perfection what nature had thus happily begun. Let us take a young Lacedemonian, sprung from the blood of heroes, whose infant motions were never restrained by those miserable shackles that cramp nature in our hapless children, who from the age of seven years has lain upon the ground, from his earliest youth has been trained up to hardship, and whose very amusements, such as wrestling, swimming, &c. have contributed to brace his nerves, to invigorate his frame, and to give force and energy to all his motions; let us take this masculine figure, and place him, in imagination, beside a modern beau, a Sybarite of our days, and then ask an able artist which of the two he will choose for his model in drawing a Theseus, an Achilles, or even a Bacchus? A Grecian painter perceiving one day two statues of the first of these heroes, of which the one had an effeminate, and the other a manly aspect, said pleasantly, "This Theseus has been fed with roses, but the other has been nourished with flesh." The application of this saying is easy and evident.

The Grecian games were a perpetual incentive to the youths to apply themselves to bodily exercises; and the laws obliged those of the youth who proposed to contend for the prize, to prepare themselves for this famous contest during the space of ten months at Peloponnesus, where the games were to be celebrated. The principal prizes were not always gained by those who had attained to the *age of manhood*, but often by *those who were* in the prime of youth, as we see by the Odes of Pindar. See the swift and active Indian, who pursues the stag in the chace! With what freedom and velocity do the animal spirits flow in his elastic and well-strung nerves! How flexible are his muscles! How nimble his motions! How vigorous his frame! The ordinary characteristic of Homer's heroes is swiftness of foot, and agility in the course.

It was in these exercises that the body acquired that masculine and noble contour which the Grecian artists gave their statues, and which had nothing in it either unmeaning or superfluous. The young Spartans were obliged every ten days to appear stark naked, in presence of the Ephori, who prescribed them a strict and severe diet, when they discovered in them the least tendency to corpulence or fatness, which are equally inconsistent with bodily proportion and vigour. There is still extant a law of Pythagoras to the same purpose; and this is undoubtedly the reason that engaged the young Greeks of the earliest ages to make use of a milk diet, during the whole time that they were preparing themselves for disputing the prize at the public games.

The Grecians avoided, with the utmost care, every thing that could have the most remote tendency either to distort the features of the face, or to destroy the proportions of the body. Alcibiades refused to learn to play on the flute, because it forced him to make wry mouths; and in this his example was followed by all the young Athenians.

Every one also knows the care that was employed by the Grecians to render their offspring beautiful, and the encouragement that the government administered to animate them in this laudable design. They carried this amiable art so far, as to attempt changing the colour of the eyes. There were public prizes proposed at Peloponnesus, as the crown of beauty; and those who were victorious in this singular contest, were rewarded with a suit of armour, that was afterwards hung up, to their honour, in the temple of Minerva. There were always competent judges to decide contests of this nature. Aristotle tells us, that the Greeks taught their children the art of drawing, with a view to enable them to judge, with discernment and taste, of those bodily proportions that constitute true beauty.

At this very day, the Grecian Isles are remarkable for the gracefulness and beauty of their inhabitants; and the female sex there retain still, notwithstanding their intermarriages with foreigners, such peculiar charms of complexion and figure, as exhibit a strong argument in favour of the transcendent beauty of their ancestors, whom, in their whimsical chronology, they look upon as more ancient than the moon. The charms of beauty are so universal among the Georgians, that a fine complexion and a comely figure are no rarities in that country.

Those fatal disorders that destroy a regular set of features, a fresh complexion, and a well proportioned form, were unknown among the Greeks: no trace of the small pox, the venereal disease, or rickets, is to be found either in the authors or the traditions of that people.

In a word, whatever art can contribute to promote the health, beauty, symmetry, and perfection, of the human body, from the state of infancy to that of manhood, was employed by the Grecians for that purpose, and rendered them the models of imitation to those who sought nature in its fairest and most graceful forms.

DUNFERMLINE MECHANICS' INSTITUTION.

It is somewhat singular, that in a town such as Dunfermline, possessing a population of from 15,000 to 20,000 inhabitants, and these being chiefly artizans and mechanics, there should not have been some measures adopted sooner for the formation of a Mechanics' Institution, or a School of Arts. We are glad, however, to have it in our power to announce, that a few public spirited individuals have at length stepped forward, and have made a movement towards the effecting this noble purpose; and ere long, when their plans shall be matured and brought into operation, the ingenious mechanics of Dunfermline, many of whose valuable communications have occupied a place in the pages of this Magazine, will have it in their power to derive all the *advantages which* a well chosen library and an intelligent lecturer are so well calculated to afford. We have written to the gentleman who suggested the idea of the Institution, on the subject, and shall be most happy at all times to give any information in our power which may be likely to prove useful, or to assist them or others in this or any similar design. In the mean time, we beg to urge upon the attention of those taking an interest in the Dunfermline Institution, the absolute necessity of its being founded on the most liberal and popular principles. Let the mechanics themselves be got to come forward, if possible, and let them have the principal share in its management, that it may, strictly speaking, be entitled to the appellation of a Mechanics' Institution.

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The deceased Mr. Miller, at various periods of his life, embarked in many important schemes of improvement; and among others, he bestowed much thought, and expended large sums on the improvement of artillery and naval architecture. In the course of his speculations and experiments on the latter of these subjects, he was led to think of devising some improved modes of constructing or propelling vessels in circumstances where the ordinary resources of the nautical art were insufficient or unavailing. Among these the construction of double and triple vessels to be moved by wheels placed in proper situations, had *occurred to him* as calculated to prove of essential service; and, accordingly, he did not hesitate in building and equipping several vessels of this description, which he considered as fully warranting his own previous expectations of advantage.

He published, at Edinburgh, both in English and French, a work entitled, "The Elevation, Section, Plan, and Views of a Triple Vessel, and of Wheels, with explanations of the figures in the engraving; and a short account of the properties and advantages of the invention."

In this work, after describing his triple vessel, and his plan of propelling it by wheels, he proceeds to say, "I have also reason to believe that *the power of the steam engine may be applied to work the wheels, so as to give them a quicker motion*, and consequently to increase that of the ship. In the course of this summer I intend to make the experiment, and the result, if favourable, shall be communicated to the public." This work was published in February, 1787; and the narrator proceeds to say, "It may readily be believed that the hint contained in this publication of my father's, of his intention to apply the power of steam to the whole of his double and triple vessels, was not hastily thrown out. In the course of his various experiments on the comparative velocity of his vessels with those propelled by sails, or by ordinary oars, which had given occasion to several interesting and animating contests for superiority, he had strongly felt the necessity of employing a higher force than that of the human arm, aided as it might be by the ordinary mechanical contrivances; and in this view, various suggestions were successively adopted and laid aside. Thus, at one time it occured to him that the power of horses might be usefully employed; while at another, the aid of the wind itself seemed to furnish the means of counteracting its own direct and ordinary operation. But among all the possible varieties of force, that of steam appears to have presented itself to his mind, as at once the most potent, the most certain, and the most manageable."

It is singular how apparently casual and unimportant an incident may lead, in the hands of an inquisitive and ingenious mind, to discoveries of the greatest importance. In Mr. Miller's family there was, as the tutor to his younger children, a most meritorious and ingenious individual, Mr. James Taylor, who had bestowed much attention on the improvement of the steam engine, and who was in the custom of assisting Mr. Miller in his experiments on naval architecture and the sailing of boats. One day, in the very heat of a keen and breathless contest, in which they were engaged with a custom-house boat on the Leith establishment, this individual called out to Mr. Miller, that they only wanted the assistance of his steam engine to beat their opponents. This was not lost on Mr. Miller, and it led to many discussions on the subject, and it was under very confident belief in its success the allusion to it was made in the work already mentioned.

The narrative then proceeds to say:

"In making his first experiments, Mr. Miller deemed it advisable, in every point of view, to begin upon a small scale; yet a scale quite sufficient to determine the problem which it was his object to solve. He had constructed a small and very handsome double vessel with wheels, to be used as a pleasure-boat on his lake at Dalswinton; and in this little vessel he resolved to try the application of steam. On looking round for a *practical engineer to* execute the *work, Mr. Taylor* recommended to his attention William Symington of the Wanlockhead Mines, whom he had known at school, and who had recently contrived a mode of applying the force of steam to wheel-carriages. My father was pleased with the ingenuity of his contrivances, and accordingly employed him, along with Mr. Taylor, to superintend the construction of a small steam engine, to be used in this projected experiment. This was in the spring of 1788; and it was not till the following month of October that the engine and machinery were completed, and placed in the pleasure-boat on Dalswinton lake. Nothing could be more gratifying or more complete than the success of this first trial; and while, for several weeks, it continued to delight my father and his numerous visitors, it afforded him the fullest assurance of the justness of his own anticipation of the possibility of applying to the propulsion of his vessels the unlimitable power of steam. On the approach of winter, the apparatus was removed from the boat, and placed as a sort of trophy in his library at Dalswinton; and, after his death in 1815, it came into my possession, and has been fortunately preserved as a monument of the earliest instance of *actual navigation by steam* of which any evidence or record has been produced.*

"In the summer of 1789, Mr. Miller directed one of his double vessels, of about 60 feet in length, to be carried to Carron, in order to be fitted up as a steam boat, by furnishing her with revolving paddles, and a steam engine suited to the supposed exigencies of the case. In this second experiment, he again availed himself of the zealous assistance of Mr. Taylor, and again employed Mr. Symington as the operative engineer. For this purpose, they were dispatched to Carron in the month of June, 1789, and I have now in my possession the original letter sent by my father to the Carron Company, as introductory to Mr. Symington's employment. It is as follows:

'*Dunfermline, 6th June*, 1789.

'GENTLEMEN,—The bearer, Mr.

---

* This little engine (4 inches diameter cylinders,) was constructed by George Watt, brass-founder, Low Calton, Edinburgh. The cylinders are of brass, and the workmanship does great credit to the artificer.

William Symington, is employed by me to erect a steam engine for a double vessel, which he proposes to have made at Carron. I have therefore to beg, that you will order the engine to be made according to his directions. As it is of importance that the experiment should be made soon, I beg also that you will assist him, by your orders to the proper workmen, in having it done expeditiously. I am ever, with great regard, Gentlemen, your most obedient humble servant,

'PATRICK MILLER.

'*Carron Company, at Carron.*'

"In spite of the anxious importance thus expressed by my father for the rapid prosecution of the work, it was not till after a lapse of six months that his vessel was ready to be put in motion. In the course of the first week of December, he directed the vessel to be taken into the Forth and Clyde Canal; and having gone aboard with a committee of the Carron Company, and a party of his friends, and in the presence of a vast multitude of curious spectators, the machinery was put in motion, and this second trial promised to be every way as prosperous as that on the lake of Dalswinton. It happened, however, unluckily, that the revolving paddles had not been made of sufficient strength; and when the engine was brought into full action, several of the float-boards were carried away, and a very vexatious stop was, for that day, put to the voyage. No time, however, was lost in repairing this damage, and, on the 25th of December, the steam boat was again put in motion, and carried along the canal at the rate of nearly seven miles an hour, without any untoward accident, although it appeared evident that the weight of the engine was an overburthen for the vessel, and that, under such a strain, it would have been imprudent to venture to sea.*

"The experiment, however, was again repeated on the two following days; and having thus satisfied himself of the practicability of his scheme, he gave orders for unshipping the apparatus, and laying it up in the store-houses of the Carron Company, and directed Mr. Taylor to call in the various accounts, and discharge the expenses which the experiment had occasioned.

"It may naturally occasion surprise and disappointment, that here I should have to terminate this account of my father's experiments on steam navigation. That he did not follow up these prosperous and decisive trials of its efficacy, with the same spirit and perseverance which had been so conspicuous in many other instances, must for ever be matter of regret to his family, as it was to himself in the latter years of his life.

"The fact, however, was, that, in the prosecution of this last undertaking, he had experienced a very violent disgust, *from the misconduct of one of those whom he had intrusted with its execution*, and had to complain not only of tardiness and negligence, but of the ill-regulated and enormous expense in which he had been unnecessarily involved. On these subjects I am unwilling to enter into farther details; but I may be permitted to add, that, by this time, my father, in the prosecution of his various schemes of a purely public nature, and without the slightest chance or expectation of reimbursement, had expended towards £30,000; and being by this time ardently engaged in agricultural pursuits, his attention was more easily turned from the objects of his former speculations, than those acquainted with his character would have been prepared to anticipate.

"Be that as it may, it cannot be disputed, in point of fact, that he had fully established the practicability of propelling vessels, of any size, by means of wheels or revolving paddles, and of adapting to these the almost boundless powers of the steam engine. In the way of pure invention, nothing farther remained to be achieved, although, in the subordinate details of execution, great room remained for minor improvements.

"Of my father's peculiar and undoubted merits as an inventor, I have endeavoured to give a fair and unvarnished account; and of the *reality* of that invention, as carried into actual practice in the years 1788 and 1789, no demonstration more unequivocal can be desired than that, with his few, but most satisfactory, experiments, the prosecution of this most momentous discovery remained suspended, for many years, in a state of inactivity and ne-

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"* *Her* planking being only three quarters *of an inch* thick, although her length *was sixty feet.*"

glect, till, at a period comparatively recent, it was revived in America and in this country, by persons who can be proved to have derived their first lights from the experiments at Dalswinton and at Carron. On that subject I am in possession of ample evidence; but, at present, I have felt no other desire than to record the facts immediately connected with my father's operations, and to establish the priority of his claims to the credit of having originated, and carried into practical execution, an improvement in the nautical art, by far the most important of which the present age has to boast, and the ultimate effects of which, on the future intercourse of mankind, the most sanguine imagination would attempt in vain to predict."

At the commencement we mentioned our intention of making no observations at present on this narrative; and we, therefore, in the meantime, leave it for our readers to make their own comments.

SCIENTIFIC INFORMATION.

Temperature of the Earth's Surface.

M. Arago has published a very interesting paper, "On the Thermometrical State of the Terrestrial Globe," in the "Almanac of the Board of Longitude of Paris for 1825," and from all his observations he draws the following conclusions.

> *In no part of the earth, nor in any season,* does the thermometer, at an elevation of two or three yards above the ground, and sheltered from all aberration, rise to 37° *of Reaumur, or* 46° *centigrade* = 114.8° *Fahrenheit.*
>
> *On the open sea,* the temperature of the air, whatever be the place or the season, *never exceeds* 24° *R. or* 30° *cent.* = 86° *F.*
>
> *The greatest degree of cold* ever observed in our globe, with a thermometer suspended in the air, is 40° *R.* or 50° *cent. below zero,* = 58° *F.*
>
> *The temperature of the sea,* in any latitude or in any season, *never rises above* 24° *R. or* 30° *cent.* = 86° *F.*
>
> *Ann. de Chim.* XXVII. 434.

Composition of Formic Acid.

Döbereiner ascertained a long while ago, that formic acid, or a formiate, when put into from 6 to 10 times its weight of concentrated sulphuric acid, was resolved into carbonic oxide gas and water, in the proportion of 24.3 parts of water, and 75.7 parts of carbonic oxide gas. Hence, it may be regarded as constituted of 1 volume of the vapour of water, and 2 volumes of carbonic acid gas; or,

	Hydrogen Scale.	Oxygen Scale.
2 atoms carbon	= 12	= 1.5
3 atoms oxygen	= 24	= 3.0
1 atom hydrogen ...	= 1	= 0.125
	37	= 4.625

According to this analysis, the equivalent number for formic acid on the oxygen scale, is 4.625. We are informed, in a note from Mr. Faraday in the Quarterly Journal, that he had observed, that the salts formed from the acid of ether, as described by M. Daniel, were resolved by sulphuric acid into carbonic oxide and water, precisely in the manner of M. Döbereiner's *formiates.*

Method of Browning Iron.

Nitric acid, ½ oz.; nitric ether, ½ oz.; spirit of wine, 1 oz.; sulphate of copper, 2 oz.; tincture of steel, 1 oz. Dissolve the sulphate of copper in rather less than a quart of water, then add the other ingredients; the whole mixture should now form a quart. To brown a gun-barrel, remove all greasiness by washing it with an alkali; the muzzle being previously closed with a wooden plug, dry the barrel well, and lay on the mixture by means of a sponge or rag. After standing twenty-four hours, it should be rubbed with a hard brush to remove the oxide. A second or a third application of the mixture will be necessary to give the barrel a perfectly brown colour: after which it should be brushed, and immersed in hot water holding some alkali in solution, to neutralize any acid that may remain on the barrel. Upon being dried, it must be rubbed with a hardwood burnisher, then heated to the temperature of boiling water, and the following varnish applied:—Spirit of wine, 1 quart; dragon's blood, in powder, 3 drs.; shell lac, in powder, 1 oz. When the varnish has dried, the barrel receives the finish from the burnisher, which gives it a fine glossy appearance.—*Silliman's Jour.* IX. p. 168.

Cold produced by the Combination of Metals.

Some striking examples of *depression* of temperature, during the liquefaction of metals, have been pointed out by Döbereiner. According to him, the fusible metal is a compound of 1 atom of lead = 103.5, (hydrogen being unity,) 1 atom of tin = 59, and 2 atoms of bismuth = 142; or it consists of 1 atom of the atomic combination of bismuth and lead, united to 1 atom of the atomic combination of bismuth and tin, and it becomes fluid when exposed to a temperature of 210°. The melting points of these alloys of bismuth and lead, and of bismuth and tin, in a separate state, are respectively between 325° and 335°, and between 268° and 280°. If 118 grains of filings of tin, 207 grains of filings of lead, and 284 grains of pulverized bismuth, (the constituents of fusible metal,) be incorporated in a dish of calendered paper, with 1616 grains of mercury, the temperature instantly sinks from 65° to 14°. He is of opinion, that it would even fall so low as the freezing point of mercury, were this experiment performed in temperatures somewhat under 32°.

In like manner, when 816 grains of the amalgam of lead, (composed of 404 mercury and 412 lead,) were mixed in a temperature of 68° with 688 grains of the amalgam of bismuth, (composed of 404 mercury and 284 bismuth,) the temperature suddenly fell to 30°; and by the addition of 808 grains of mercury, (also at 68°,) it became so low as 17°: the total depression amounting to no less than 51°.—*Ann. Phil.* IX. 389.

Colour of Glass affected by Light.—Mr. Faraday states, in the last Number of the Quarterly Journal, that glass having a green tint, from its containing iron, by long exposure to solar light, becomes nearly colourless. Glass of a pale colour, or even colourless at first, by long exposure to the solar rays, acquires a pink colour, whilst portions of the same glass retained in the dark suffer no alteration. Oxide of manganese is added partly to neutralize the green tint which otherwise would be conferred by iron. The lilac colour that some glass windows exhibit, when seen before a white curtain or shutter, is most likely derived from the presence of manganese.

◆

SITTINGS OF THE FRENCH INSTITUTE OF THE 18TH JULY.

M. Moreau de Tormes stated *that the alarming* reports of the *plague at* Marseilles were without foundation; it does exist at Alexandria in Egypt, and had been communicated to many European vessels, of which five were French, and had lost part of their crews, but on the arrival of two of these vessels, only one man was attacked by the plague, and there are hopes of his recovery. M. Moreau de Tormes remarks as a singular occurrence, that the yellow fever of the West Indies and the plague of Egypt have been, for the first time, concentrated on the same spot, by the simultaneous arrival of vessels from the West Indies and Egypt at Marseilles.

M. Arago stated that he had endeavoured to ascertain whether the stars which we consider as the nearest to us, were not susceptible of presenting a visible parallax. He made his observation on the 61st star of the Swan; this group consists of two stars, which like all others improperly called fixed stars, has nevertheless a real motion in space, and performs its revolution in 500 years; the proper motion of one of these stars is 5″ 3 per annum, which shows that it really moves through 206 times the space of the radius of the earth's orbit every year, that radius being 34 million leagues. The motion of this star being the most evident of any, M. Arago hoped to be able to discover a sensible parallax, in which he had been disappointed as well in it as in the other connected with its system.

M. Arago also stated to the academy that he was occupied in ascertaining, with greater precision than had been done hitherto, the diameters of the planets; he has already made about 4000 observations, which he promises hereafter to communicate; at present he only states, that hitherto his telescope has not been subject to any sensible irradiation. It has been considered that telescopes presented the planets larger than they are, and this was called irradiation, which Newton estimated at 3 to 4 seconds, which would produce a great error. His first object, therefore, was to examine the irradiation of his telescope, first by Newton's method, but that being difficult, he employed another, and from repeated experiments, he found the irradiation insensible as to terrestrial objects. He then essayed it on one of the satellites of Jupiter, and its shadow, which gave exactly the same diameter. He then essayed his telescope on the planet Venus: he first observed it in the superior conjunction, after which he quintupled the diameter, to have the diameter of the former planet, when at its inferior conjunction it should be nearer to us. If, therefore, in the first observation, the instrument had enlarged the diameter of the planet, the error would be quintupled. Now, the diameter of Venus, at its inferior conjunction, was precisely what M. Arago obtained by calculation, consequently the first observation showed no error; and it is therefore certain that there are telescopes which present no irradiation.

M. Cuvier made his report on the Zoological part of Duperre's expedition, and points out the very great importance of the study of natural history and drawing, in all naval colleges and marine schools, with the art of preparing and preserving objects of natural history; this he considers as calculated greatly to extend the domain of science.

USEFUL RECEIPTS.

To make good Yeast.—Thicken two quarts of water with fine flour, till it be of the consistence of common water gruel, then boil it half an hour, and afterwards sweeten it with near half a pound of brown sugar. When it is almost cold, pour it into a large jug upon four spoonfuls of yeast. Shake it well together, and let it stand uncovered a whole day before the fire, in order to ferment. The fermentation will throw up a thin liquor to the top, which must be poured off. Shake the remainder, and cork it up for use. A gill and a half is sufficient to ferment a peck loaf. Four spoonfuls of this artificial barm will make a fresh quantity, and so on in succession.

N. B. This barm has been frequently tried, and makes very good bread; not quite so light as fresh barm, but it by no means renders the bread heavy or testy.

To take an impression from a Copper-plate on Plaster of Paris, with colour, as in common prints.—Let the plate be filled with ink, (made of the best ivory black, mixed with drying linseed oil, and ground very fine on a painter's stone,) and the surface cleaned with the hand and with whiting, as in common copperplate printing; provide yourself with a board, about half an inch thick, just the size of your plate; round the edge of this, wrap some stiff paper, raised half an inch above the surface on one side, and level on the other, in form of a trough; into this put your plate, with the prepared side upwards; then mix your plaster of Paris with water to a proper consistency, and pour it on the plate; then, lifting up the trough, let it fall flat upon the table again, to drive the bubbles of air from the plate, through the surface of the plaster; which, after you have repeated about twelve times, let it stand an hour; afterwards take the plate out of the trough, and the plaster, now hardened, from the plate; and you will have a very neat impression on the plaster, fit to put in a frame, and by far preferable to the best prints.

To obtain fresh blown Flowers in Winter any day one chooses.—Choose some of the most perfect buds of the flowers you would preserve, such as are latest in blowing, and ready to open, cut them off with a pair of scissors, leaving to each, if possible, a piece of the stem about three inches long; cover the end of the stem immediately with sealing wax; and when the buds are a little shrunk and wrinkled, wrap each of them up separately in a piece of paper, perfectly clean and dry, and lock them up in a dry box or drawer; and they will keep without corrupting. In winter, or at any other time, when you would have the flowers blow, take the buds, over night, and cut off the end of the stem sealed with wax, and put the buds into water, wherein a little nitre or salt has been infused, and the next day you will have the pleasure of seeing the buds open and expand themselves, and the flowers display their most lively colours and breathe their agreeable odours.

☞ On Wednesday next, a Supplementary Number will be published, which will conclude our third volume. This Supplement will contain a splendid engraved Portrait of Professor ANDERSON, the illustrious father of Mechanics' Institutions. It will be finished in the best style of line engraving, and is taken from a scarce etching in the possession of ALEXANDER M'GRIGOR, Esq. of Kernock, in which, we have the best authority for stating, the likeness of this venerable philosopher and philanthropist is remarkably well preserved. We have also the satisfaction of announcing, that we have procured a most interesting biographical sketch of the life of the Doctor—the only one which has yet appeared in print.

NOTICES TO CORRESPONDENTS.

Mr. Dixon Vallance's communication will appear in an early Number of our next Volume, and several of our other Correspondents, who have been unavoidably postponed, will likewise soon appear. A. B., X. Y. Z., Querist, A Mechanic, &c. have been received. We have to thank Mr. Lovat, Staffordshire, for his well meant communication, but we really cannot insert it, as it would be quite aside from the purpose of our Magazine to do so.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

Published every Saturday, by W. R. M'PHUN, 155, Trongate, Glasgow, to whom
Communications (post paid) must be addressed.

CURLL, PRINTER.

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